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# The skills-maintenance, competence paradigm for the evolving role of a Paramedic

Henderson, Tristan

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University of Plymouth

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**UNIVERSITY OF  
PLYMOUTH**

**The skills-maintenance, competence paradigm for the evolving role  
of a Paramedic**

**By Tristan Henderson**

A thesis submitted to the University of Plymouth in partial fulfilment for  
the degree of

**DOCTOR OF PHILOSOPHY**

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### **Authors Declaration**

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other university award without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree, either at the University of Plymouth or another establishment.

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# **The skills-maintenance, competence paradigm for the evolving role of a Paramedic by Tristan Henderson**

## **Abstract**

The UK paramedic profession has undergone significant development since professional regulation almost twenty years ago. Improvement planning within the NHS has also driven change. The result is a large and developing paramedic skill set.

The skills performed and incidents attended by paramedics are highly variable in relation to the frequency with which they will be encountered as well as the procedural complexity. This consideration, in the context of the literature around clinical skills practice, competence, confidence and perception of performance invites inquiry in relation to competence of paramedics, as well as their ability to recognise practice issues.

The aims of this study were to: (i) develop a map of incidents attended and skills commonly used in one UK ambulance service, (ii) assess the performance of clinicians across different types of skills and (iii) explore clinicians' perceptions of their competence and confidence in relation to their objectively assessed performance. The study was carried out in two phases: Phase one was a retrospective review of clinical records (n=600), seeking to establish the frequency of incidents attended and skills practiced by UK paramedics and Phase two examined actual and perceived competence in clinical skills across a range of frequency and complexity, it also explored confidence (n= 69 paramedic participants). This was achieved through participation in a simulated clinical scenario and completion of a number of measures, participants also completed questionnaires in relation to the scenario and clinical skills.

Phase one results highlighted the stark infrequency of time critical incidents and life-saving skills; however, it showed minimal variation when examined by location and time of year. In phase two participants were generally able to demonstrate accurate insight in relation to their performance although sometimes under/over-estimated their competence. There was positive correlation between both confidence and competence pre and post scenario. There were however some notable issues with some 'soft' skills affecting consent. Complexity of skill did not impact performance although some participants scored lower when practicing 'simple' skills. Regular, exposure and practise was reported by participants to help the maintenance of competence and confidence in all skills.

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## **Glossary of Terms**

AACE	Association of Ambulance Chief Executives
ACS	Acute coronary syndrome
AHP	Allied health professionals – health professionals that work alongside nursing and medical staff
Auscultation	The action of listening to sounds, usually the lungs, heart or bowel
Ambulance Care Assistant	Non-emergency ambulance service role
Ambulance Technician	Emergency ambulance service role below paramedic
Competence	Having the necessary ability, knowledge or skill to do something successfully
Confidence	Belief of an individual in their ability to undertake a skill
CoP	College of Paramedics - Professional body for paramedics
CPD	Continued professional development
Cricothyroidotomy	Creation of a hole through a person's neck to enable ventilation when the upper airway is obstructed
Electrocardiogram	ECG, assessment of the electrical activity within the heart
Endoscopy	Use of an endoscope to look at internal organs
Endotracheal intubation	Placement of a tube in the Trachea to enable ventilation

Evidence based practice	Use of evidence to guide clinical/treatment decisions
FAST	Face, arm, speech test – an assessment tool for suspected cerebral bleeds
GCS	Glasgow Coma Scale, a neurological assessment tool
HCPC	Regulatory body for paramedics
Homogeneity	Extent to which something is the same
Immobilisation	Prevention of movement in part of the body, usually a limb or the spine
Intraosseous access	Placing a needle into the medulla of a bone for the administration of fluids and drugs
Intravenous (IV) Cannulation	Placing a tube in a vein for the delivery of drugs
JRCALC	Body providing guidelines for paramedics in the UK
Laryngeal mask airway	Intermediate airway adjunct that sits above the epiglottis
Laryngoscopy	Visualisation of the larynx/throat, often using a laryngoscope
Nasopharyngeal airway	Airway adjunct that is placed into the pharyngeal space via the nose, to help maintain a patient's airway

Needle Cricothyroidotomy	Emergency procedure that involves passing of a large bore needle through the cricothyroid membrane to enable oxygenation in a patient with an occluded airway
Needle Thoracocentesis	Emergency procedure involving placement of a large bore needle through the chest wall into the plural cavity
NHS	National Health Service
Oxygen saturation	Amount of oxygen (measured as a percentage) in capillary blood
Paramedic	An autonomous healthcare professional, usually working in an 'unscheduled care role'
Patient Clinical Record	A record of attendance, assessment, management and disposal for patients, completed by paramedics
Practice Educator/s	Operational paramedics who support undergraduate paramedic students in practice
Provisional diagnosis code	Code identifying the suspected presenting condition of a patient
Psychomotor skills	Movement tasks
QAA	Organisation that safeguards standards of UK universities
Rubric	A set of instructions or rules
Scope of practice	Procedures actions and processes carried out by a clinician

Self-perception	How an individual sees them self
Skill-set	Range of skills
Specialist Paramedic	Paramedic practicing in a specialist area such as critical care and primary care
SPSS	Statistical Package for the Social Sciences, a software package for data analysis
Supraglottic airway	Intermediate airway adjunct that sits above the epiglottis
Tourniquet	Device applied to a limb that restricts blood-flow – used during intravenous cannulation
Trauma	Physical injuries

## **Chapter One: Introduction to the Thesis**

### **1.0 Introduction**

Paramedicine, like just a few other medical professions has a nature which is 'specialist generalist' (Lovegrove & Davis, 2013). As such, paramedics are expected to be able to manage any situation that may present itself, from a minor wound to a serious road traffic collision with multiple casualties. In addition to this, within an ever changing National Health Service (NHS) the paramedic role has advanced at a rapid rate in recent years. Acceptance of this situation by the profession offers some challenges at the point of care delivery based on competency levels of paramedics.

Changes have taken place within the profession that have to some extent mitigated the development previously mentioned; an example of these would be the development of specialist roles such as specialist paramedics in critical care. Despite this move, the general, basic role of paramedic has become more complicated and difficult to perform with greater public expectation and a larger number of skills available to use (AACE, 2011; Bradley, 2005; Edwards, 2014; Lovegrove & Davis, 2013).

In this chapter, the context for the study is provided. As the focus of the study is on the paramedic skillset, in relation to skills frequency as well as competence and confidence, an overview of the development of paramedicine is also provided, highlighting the trajectory along which paramedic skills have developed and been influenced by political drivers. This is followed by an overview of the theoretical constructs underlying skills development that will form the basis for future chapters. The chapter concludes with identification of the study aim and objectives.



## **1.1 General History of Paramedicine**

Paramedicine has a relatively short history in the UK, as the following sections will highlight. This short history has seen development of a role with increasing clinical autonomy, changes in educational approaches and professionalisation, with regulation and the development of a professional body, the College of Paramedics (CoP) (Bradley, 2005; CoP, 2015).

### **1.1.1 Early Ambulance Services**

Ambulance Services in the UK were created with the birth of the NHS in 1946. People working within these early services were typically manual workers with first aid qualifications. The Millar reports on ambulance training and equipment in 1966 led to ambulance service staff undertaking eight weeks basic medical training followed by a year 'probation', successful candidates were then awarded the 'Millar Certificate' (Kilner, 2004). This programme included greater input into the curriculum from professions such as nursing and midwifery. The same report stopped short of recommending extended skills for ambulance staff and instead adopted a 'training' based focus, with recommendations for equipment and minimum training levels (Blaber, 2012; Ministry of Health Scottish Home and Health Department, 1966).

During the beginning of the latter half of the twentieth century, UK ambulance services operated in a largely isolated way, under local authority control. Services in different parts of the country operated under different guidelines and employed various grades of clinical staff. In addition to this confusing picture, during the early 1970's, various 'advanced skills' schemes were set up for ambulance staff; these can now be seen as the pre-cursors for paramedic training/education (Brooks, Cooke, Spencer & Archer, 2016).

### **1.1.2 Advanced Care Schemes**

Advanced care schemes were generally driven by local doctors who had an interest in prehospital/emergency care. Two examples of such schemes were that set up by Dr Douglas Chamberlain in Brighton, 1971 and Dr Peter Baskett in Bristol, 1972. Following the success of these, similar schemes grew across the country; the focus of these often differed, depending on the medical viewpoint of those people involved in setting them up. The scheme in Bristol initially involved an ambulance stationed at the hospital equipped with oxygen, entonox and cardiac monitoring. In Brighton, ambulances were being equipped with defibrillators and staff being trained to use them. Regardless of the area, there was discussion over the cost effectiveness of 'upgrading' the care provided by ambulance services with the general feeling that the investment was worth it when considering lives saved and parity of care (Wright, 1985).

Expansion of these schemes began to transform ambulance service staff from the previously mentioned manual worker with a first aid qualification to paramedics with advanced medical skills, recognised as healthcare professionals in their own right, able to appreciate complex clinical situations and manage them accordingly (AACE, 2011; Bradley, 2005; CoP, 2015; Lovegrove & Davis, 2013).

Following the NHS Reorganisation Act, 1973, responsibility for ambulance services, and the various advanced schemes that had, up to now been run by County Councils was passed to the NHS (Blaber, 2012). In 1979, the Medical Commission for Accident Prevention (MCAP) deemed that ambulance staff would be well placed for training in advanced resuscitation techniques, due to the professional positioning of their role (Lucas, 1979). This shift was helped by the technical advancement of

medical equipment like defibrillators that meant this was a realistic possibility (CoP, 2015).

Over the next few years the Department of Health commissioned research into the benefits of offering this advanced 'paramedic' type training; the outcomes supported the move. In 1985 a UK wide pilot scheme was established to do this, it brought together many of the aspects from the existing but individual schemes that had been running. This meant that there was now a national package that could be taught within the ambulance training colleges in the UK. It saw a significant shift in skill set for ambulance staff, from a traditional 'basic life support' capability, focussed on transportation, to the provision of 'advanced life support' techniques aimed at improving patient outcomes (Brooks *et al.*, 2016).

During the 1990's ambulance services became NHS Trusts and the profession, as well as services, continued to develop. In addition, skills previously the domain of more qualified clinicians began to filter into other roles, such as ambulance technicians being allowed to nebulise drugs and use defibrillators (Blaber, 2012).

### **1.1.3 Early Paramedic Training and Practice Guidance**

The NHS Training Division (NHSTD) provided the extended training route through ambulance service training colleges', this was now a standardised qualification for paramedics. The NHSTD later became the Institute for Health and Care Development (IHCD), who continued to offer standardised paramedic training (CoP, 2015). The IHCD ambulance service programme took a modular, blended learning approach and provided a route for staff to enter the ambulance service in a non-emergency role (Ambulance Care Assistant), before progressing into emergency work as an Ambulance Technician and then moving on to the role

of Paramedic (Blaber, 2012). There was at this point no direct route to becoming a paramedic. Despite this standardisation there were still local variances in ambulance trusts across the UK, such variances continue to exist, as highlighted by the CoP paramedic evidence based education project (PEEP) report (Lovegrove & Davis, 2013).

With ambulance services now under control of the NHS and standardised training in place, the Joint Royal College Ambulance Liaison Committee (JRCALC) had its inaugural meeting in April 1989. The committee aimed to provide clinical advice/guidance to ambulance services and their clinicians throughout the UK. This was done largely through the creation of clinical practice guidelines in 2000; in addition, JRCALC has also made comment on various issues of relevance to paramedicine, as was seen in 2008 with their involvement in a debate over the efficacy of paramedics practicing endotracheal intubation (JRCALC, 2008).

Some JRCALC guidance was adopted fully by ambulance trusts and some was not; nationally this created a situation where once again, in the UK, varying prehospital care practices were being employed by ambulance trusts; a circumstance that contributed to different standards of care being delivered, what became widely known as the 'healthcare postcode lottery' (Marmot, 2010).

#### **1.1.4 Development of Paramedic Education Programmes**

During the 1990's, in the face of the still emerging, relatively standardised role of the Paramedic, some started to question the current underpinning knowledge of their practice, using advanced skills under little or no supervision. A more in depth approach to preparing the paramedic workforce for practice was called for, this route needed to have a focus on education rather than training; it needed to focus on

deeper knowledge and the benefits that are associated with this knowledge rather than surface learning traditionally employed by paramedics (Cooper, 2005; Lovegrove & Davis, 2013; Ryan & Halliwell, 2012). It was considered by many that the now mainstream IHCD training route focussed largely on pattern recognition rather than clinical reasoning and decision making (Ryan & Halliwell, 2012).

In 2004 the Quality Assurance Agency (QAA) for Higher Education produced the benchmark statement for paramedic science. The aim of this document was to provide a description of what 'paramedic education programmes' should look like, as well as what qualities/attributes those on them should possess. This document and subsequent revisions serve as a guide for the development of education programmes in order to offer more in depth education to the future paramedic workforce (QAA, 2016).

The above guidance from the QAA was designed to apply to all stakeholders within paramedic education/training, including the IHCD; however, the focus was beginning to shift towards the advent of university education. By the time this document was published there were already various university routes to paramedic registration available.

### **1.1.5 The Professionalisation of Paramedicine**

In the year 2000 paramedics became registered professionals, within the now Health and Care Professions Council (HCPC). Since this development all paramedic education/training programmes have been required to undergo review by the HCPC, who will approve the course provided it is fit for purpose. Candidates who have met the academic requirement of such a programme can then enter the register as a paramedic (HCPC, 2018a).

The British Paramedic Association (BPA) was formed in 2001, later becoming the College of Paramedics (CoP); the purpose of this organisation was to represent paramedics in the UK, as required by law for registered professional groups. The CoP have published a curriculum guidance document since 2006, for education programmes, this is now in its 5<sup>th</sup> edition. This offers a framework for higher education institutes and other stakeholders in relation to training and education provision for paramedics in the UK.

In 2013 the CoP also published the Paramedic Evidence Based Education Project (PEEP); this report sought to provide an evidence based business case for the future standardisation of university paramedic education. Perhaps one of the most significant things that this report did was set a timescale for the profession to become all graduate, by 2019 (Lovegrove & Davis, 2013). In addition, scope of practice was raised with specific comment made on the wide variation found in different areas within the UK (Lovegrove & Davis, 2013). This prompted the CoP to publish the 'Paramedic – Scope of Practice Policy' in 2015, revised in 2018 (CoP, 2018a).

More detail on the regulatory and professional history of paramedicine can be found in Appendix 1.

### **1.1.6 Political Drivers**

Taking Healthcare to the Patient (Bradley, 2005) was a seminal publication for UK ambulance services and provided strategic direction for trusts in the context of a changing NHS. It advocated a move for paramedics to a higher education model in order to provide a contemporary service that meets the needs of its patients (Bradley, 2005). One of the specific observations made within the document was the

imbalance between the types of incident actually attended by paramedics and those trained for.

In 2011, the Association of Ambulance Chief Executives (AACE) published 'Taking Healthcare to the Patient 2: A Review of Six Years Progress' (AACE, 2011). It continued to advocate the movement to higher education for paramedicine; however, it went one step further with the assertion that the now dated, surface learning focussed training route provided by the IHCD should be discontinued by 2013 (AACE, 2011). The political drive for change in UK ambulance services has continued with an NHS England report advocating the need to develop paramedic training and skills so that more patients can be left at home (NHS England, 2013), thus improving their experience, preventing referrals to hospital and relieving pressure on acute departments.

## **1.2 The Skills Practice Challenge for Paramedics**

Paramedics in the UK practice a wide variety of skills within the traditional role (CoP, 2018a), maintaining competence in these can be a challenge in relation to frequency of performance and complexity. In addition, confidence of the paramedic will likely be a factor affecting performance (Pusic, Kessler, Szyld, Kalet, Pecaric & Boutis, 2012).

### **1.2.1 Increasing Demands on Paramedics**

The almost unique specialist generalist nature of paramedicine means that paramedics are expected to retain a large amount of knowledge to perform their everyday role. In addition there are now a much wider range of opportunities now available to paramedics such as 'specialist' roles in

primary/urgent or critical care (Newton, 2011). Increasingly, as the profession advances, paramedics are practicing a wider range of skills; this is not exclusively within specialist paramedic roles, but also within the standard paramedic role. Some of these skills are infrequently utilised and relatively complex, potentially impacting on confidence and competence.

Meeting the standards of proficiency for paramedics (HCPC, 2014) is one of the first steps in a paramedic's career; continuing to meet them is then an on-going, career-long requirement. In the context of a growing skill-set it is perhaps over simplistic to imagine that clinicians will simply progress through their careers continually managing to maintain the HCPC standards. This issue was discussed in a commentary piece for the Journal of Paramedic Practice, raising the possibility of a need for 'paramedic licenses'. The article proposed the introduction of a paramedic licence, requiring annual revalidation that would ensure that paramedics are reassessed in specific skills throughout their careers and therefore always fit for practice (Woolcock, 2012).

### **1.2.2 Regulatory, professional and educational aspects**

#### *HCPC*

The HCPC publish several documents that inform its registrants about the standards required of them, such as the standards of proficiency and the standards of conduct performance and ethics (HCPC, 2014; HCPC, 2018c). These are broad in nature and in the context of the large scope of practice already discussed it is easy to see how this presents some very real challenges for paramedic registrants.



## *College of Paramedics*

The CoP Curriculum Guidance document (CoP, 2019) concurs with HCPC standards of proficiency in specifying the need for a paramedic to be able to manage patients ranging from the preterm infant to the older adult. The guidance specifies that care may involve assessment, treatment and management of a patient ranging from a minor to a complex nature. It is worth remembering that within this context, many minor illnesses/injuries can actually be very complex to deal with and attract the greatest amount of litigation within healthcare (AACE, 2011).

The latest iteration of the curriculum guidance document highlights the need for a 'spiral curriculum', where subjects can be revisited at deeper knowledge levels and understanding as paramedics progress through their careers. This demonstrates a need for advancing cognitive ability and knowledge, and highlights a clear career pathway that promotes lifelong learning/development in order to 'keep up' with the demands of the role (CoP, 2019). The ideology behind this is sound; however, maintaining standard paramedic skills whilst progressing through a career or managing an expanding skill-set is a large challenge for paramedics.

The CoP Post Registration paramedic Career Framework document describes the development of the contemporary paramedic role and the wide variety of clinical positions that can be held by paramedics (CoP, 2018b). Figure 1.1 shows this in pictorial form. The same document defines four separate pillars of development which can also be seen in the outer ring of figure 1.1 (clinical practice, leadership and management, research and development, and education), these acknowledge that paramedics will develop and specialise in various domains/combinations of domains following graduation, partially due to the variety of practice areas already

mentioned and the challenges in maintaining advanced knowledge and skill in all areas of practice.

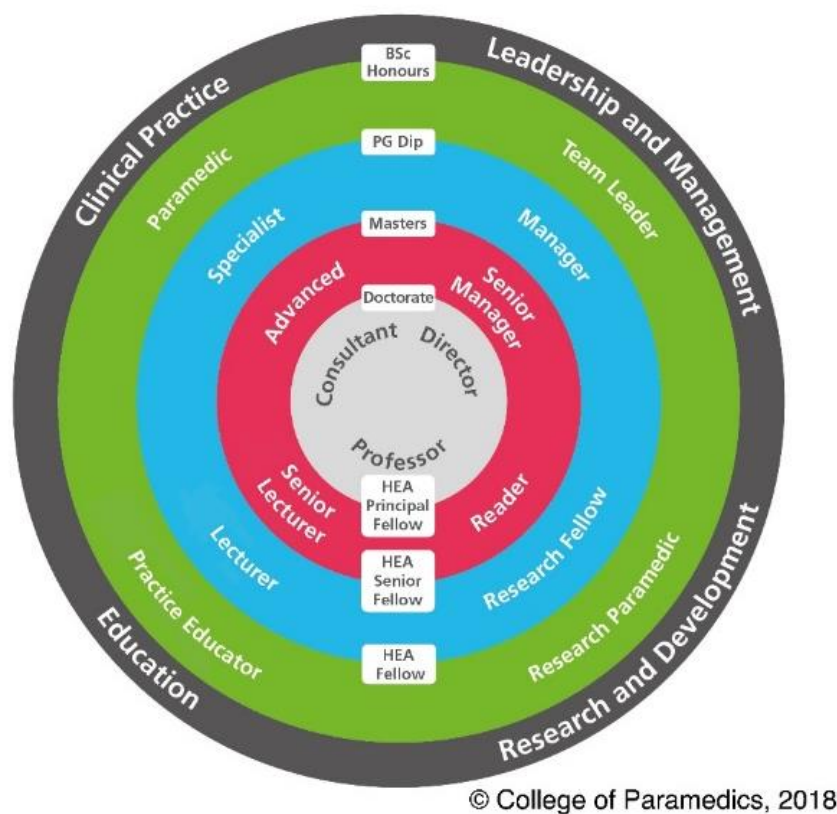


Figure 1.1, College of Paramedics, Career Framework 2018 (CoP, 2018b)

The Health Education England document, *Multi-professional Framework for Advanced Clinical Practice in England* built on the idea of the postgraduate paramedic role. It explained the role of Advanced Care Practitioners, coming from various professional backgrounds (including paramedicine), educated to level 7 and able to provide high quality care by focussing on the patients situation needs rather than their own role (England, 2017). Following this the HEE paramedic specialist in Primary and Urgent Care Core Capabilities Framework was written, with significant input from paramedics and is endorsement by the CoP. It demonstrates further, that

the role of the paramedic has expanded and therefore specific guidance is required to work in certain areas, such as primary and urgent care. It uses the CoP four pillars of development already discussed to do this. The same document qualifies that in addition to any new knowledge/skills required to work on various specialist roles, a paramedic must continue to meet the professional standards set by the HCPC (HEE, 2019).

Further contextual background relating to the Health and Care Professions Council and the College of Paramedics can be found in appendix 1.

### *Training/Education*

The paramedics working within UK ambulance services have currently come through various education routes, such as traditional HEI full time, various 'bridging' part time and ambulance service 'in-house' programmes overseen by the IHCD.

Paramedicine has long been considered a vocational career (Bradley, 2005; Cooper, 2005); however, contemporary discussion has supported the evolution of ambulance service education becoming solely HEI based (AACE, 2011; Bradley, 2005; Cooper, 2005; CoP, 2019; Lovegrove & Davis, 2013), something now definitely set to happen following the Paramedic Evidence-Based Education Project. This document asserted that the change would reflect the challenging work undertaken by those practising in the contemporary paramedic role (Lovegrove & Davis, 2013). Following a consultation period in 2018, the HCPC decided to support this, a deadline of September 2021 was set, whereby approval for any non-BSc (Hons) degree programme will be withdrawn by the HCPC (HCPC, 2018b). The HCPCs Standards of Education

and Training (SETs), ensure that programmes resulting in paramedic registration for successful candidates meet regulatory body requirements (HCPC, 2018a), preparing students for registration and practice. Therefore, graduates of HCPC approved university paramedicine programmes should, as previously mentioned, on graduation, be able to demonstrate that they meet the standards of proficiency at threshold level (HCPC, 2014).

### *Government Policy*

The rapidly advancing professionalisation of paramedics, triggered largely by government policy, has seen them expanding their practice in multiple areas already discussed. This is demonstrated best in the Taking Healthcare to the Patient publications, 1 & 2 (AACE, 2011; Bradley, 2005).

Within the urgent and emergency care context, growing emphasis has been placed on treatment in the community, rather than arbitrary transportation to hospital, this was widely discussed in a review of urgent and emergency care provision (NHS England, 2015). In parallel with this, the public expectation of paramedics has increased along with the growing paramedic skill-set (Bradley, 2005; Edwards, 2014). These factors mean that there is now a far greater drive for paramedics to treat patients at home or refer them to other services, rather than simply transport them to hospital (Bradley, 2005; CoP, 2018a; CoP, 2019; Petter & Armitage, 2012), requiring greater knowledge and skill from the clinician.

The opposite end of the assessment and treatment spectrum for paramedics has seen a drive to improve the care provided for the seriously injured patient, as can be seen with publications from the National Audit Office (NAO) and the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) (NAO, 2010;

NCEPOD, 2007). This obviously does require transport to hospital as well as the execution of various clinical procedures. Serious illness and management of patients is also constantly under development/review with guidelines such as the recent National Institute for Clinical Excellence (NICE) guideline for the recognition, diagnosis and management of sepsis (NICE, 2016) and the multiple reviews of the 2008 guideline for the management of Stroke and transient ischaemic attack (NICE, 2008).

These developments have resulted in the introduction of new equipment, skills and patient management pathways for paramedics to use. Many of these new skills/pathways focus on managing patients with specific life threatening emergencies, a patient group accounting for a what is suggested as less than 10% of ambulance service workload and thought to be less than 0.2% of NHS emergency department workload (Bradley, 2005; NAO, 2010; NCEPOD, 2007). The result of this situation is that there are now multiple paramedic skills/incident types that may be used/encountered very infrequently.

Paramedic practice is further complicated by a consistent trend of rising ambulance service use by the public (Edwards, 2014), meaning there is little time to engage in practise/simulation within the normal working day. This concern was identified by paramedics in relation to opportunities for continued professional development (Cooper, 2005). The same study highlighted that prior to the advent of HEI education, paramedics would undergo a five yearly recertification, including hospital placements; research suggested that despite the lengthy timescale, this maintained their confidence by revisiting rarely practised skills (Cooper, 2005).

The issues around increased skills sets, increasing demand for ambulance services and rising public expectation highlight potential challenges within paramedic practice

relating to confidence and competence due to pressure and expectation; they also potentially impact on the following in relation to service delivery:

- Patient safety
- Public confidence in the paramedic profession
- Organisational liability for ambulance services
- Training/education needs of ambulance services

The above situation has created an environment whereby the paramedic role has been in a varying but constant state of flux since its inception.

In summary, there has been an expansion of paramedic roles including changes in skill sets and practice environments, alterations in the educational setting and content and increasing work demands. This has led to a wide range of required skills some of which are complex but infrequently used, with a reduction in working hours practise time. This in turn could impact on paramedics' confidence as well as actual and perceived competence. Competence could in part reflect the complexity of a skill. What is a skill and how it varies in complexity will be explored in the next section.

### **1.3 Skills and Blooms Taxonomy of Levels of Knowledge**

It is important to define the skills that paramedics undertake and what a skill actually is. Although this initially seems simple, finding an accurate definition can be difficult (Michels, Evans & Blok, 2012). A skill can be broadly defined as the ability to do something well; however, this does not address the multiple facets of carrying out medical procedures in dynamic environments. It has been suggested that skills can be open or complex, open requiring movement of multiple limbs and complex being

completed in uncertain circumstances (Bjørk & Kirkevold, 1999); however, it is unlikely that these (open and complex) exist in isolation when considering the detailed nature of many standard paramedic skills such as airway management and intravenous cannulation. Alternatively, skills can be thought of as various domains, mostly physical but also including non-physical elements such as clinical reasoning and communication (Michels, Evans & Blok, 2012). This concept of domains links well with the idea of skills being technical and non-technical, sometimes termed 'hard' and 'soft'; technical (hard) being denoted by physical action and non-technical (soft) by the use of cognitive and social skills, such as communication and clinical reasoning (Shields & Flin, 2013).

When undertaking skills, paramedics are operating in a variety of environments that require the evaluation of complex information, communication with multiple agencies and often complex decision making, these factors can all have a negative impact on skill learning and performance (Brady, 2008). The reality of paramedic skill lies somewhere between these rigid definitions where skills have physical elements that also require communication and clinical reasoning to be used properly, a secondary factor is the challenging environment in which paramedics tend to practice.

Blooms Taxonomy, shown in figure 1.2 shows different levels of knowledge that can be used to help classify the skills that are commonly used. It has levels from basic memory up to the more advanced ability to evaluate complex information (Bloom, Engelhart, Furst, Hill & Krathwohl, 1956).

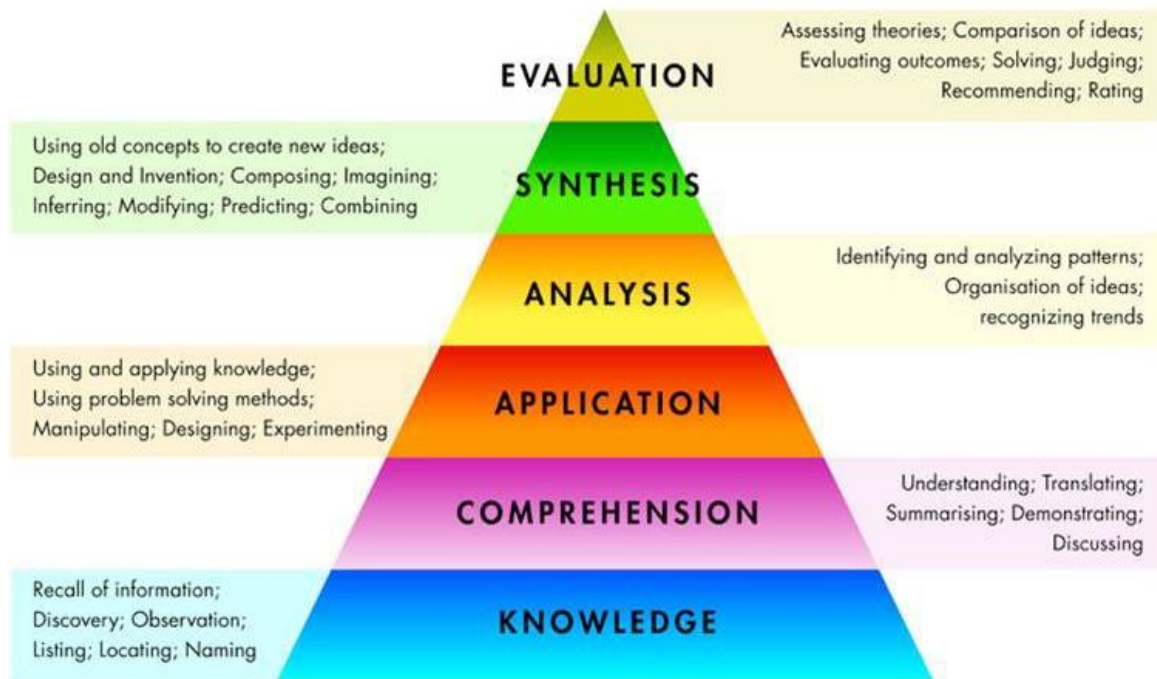


Figure 1.2, Blooms Taxonomy of Learning

The ability to operate at increasing cognitive levels, as in this model, directly relates to an ability to operate in the increasingly complex environment of prehospital care (CoP, 2019). As a result, it seems evermore important that encouragement for development of these higher cognitive skills for paramedics is offered.

This is reviewed at various points throughout the thesis; in Chapter two a critical discussion is provided regarding what defines a clinical skill and the evidence base for the skills that paramedics require and use. This is further expanded upon in the final discussion in chapter six. In chapter four the type of skills that paramedics perform and their frequency of usage are defined through an audit of paramedic practice. This will help to define the paramedic skill set in more detail.

The frequency of use and complexity of skills used by paramedics could affect their actual and perceived competence over time. Actual and perceived competence in a skill and their inter-relationship are thus important issues for a paramedic profession that aims to maintain the highest standards of clinical care for its patients. With this



in mind the theoretical issues around skill development and perceived competence will now be discussed.

#### **1.4 Skill Development and Perceived Skill Competence: Theoretical Context**

This section provides an introduction into some of the theoretical concepts linked to skill development and perceived competence that will later feed into both phases of this study. It aims to bring different concepts together to provide a starting point for consideration of the issues of skill development and competence that will form the focus of this thesis.

Examination of professional, educational and regulatory requirements often returns to the need for paramedics to achieve then maintain, as a minimum, a threshold level for practice (CoP, 2015; HCPC, 2014). This requirement is the same for all actions and skills, regardless of complexity or frequency of exposure. The context of the paramedic role is important; paramedics are often required to make decisions in unfamiliar, changing and challenging environments (CoP, 2015; QAA, 2016). In addition, the clinician may not be or feel familiar with the skill if they have not used it recently or regularly. This raises potential questions about performance and confidence, both in managing situations of varying complexity and frequency.

The conscious competence learning matrix suggests that learners will progress through various points of competence and awareness, beginning with unconscious incompetence and ending in unconscious competence having progressed through a journey of enlightenment (Higginson & Hicks, 2006). Perhaps a more widely used and recognised model within healthcare is the five stage model of skill acquisition (Dreyfus, 2004), which charts a path from novice through to advanced beginner and

then competence before achieving proficiency and finally expertise; there are some obvious comparisons with the conscious competence learning matrix in that both models chart development; however, the five stage model is not quite so concerned with the conscious/unconscious dimension. The concept of deliberate practice feeds into this learning development, it is an active learning process, rather than simply, passively expecting performance to improve with time. It requires specific learning outcomes and feedback with a view to constantly improving to achieve expert status (Ericsson, 2008).

The need for paramedics to be conscious of their skill level is important, without this perception logic dictates there will be no perceived need to improve performance.

The Dunning-Kruger (DK) effect concept describing a cognitive bias, where a person lacks the ability to recognise their own good/poor practice; in this way it builds on, and links to the cognition aspect of the conscious/competence matrix, in that certain groups struggle to identify their own performance levels and needs, due to a lack of knowledge or cognitive ability (Kruger & Dunning, 1999). In relation to actual performance and its maintenance, forgetting curves suggest that when not practiced for a period of time, performance will degrade exponentially, that is rapidly at first before slowing and maintaining at a constant lower level (Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012). The above theory and concepts can be seen in relation to their interaction with each other and competence in figure 1.3.

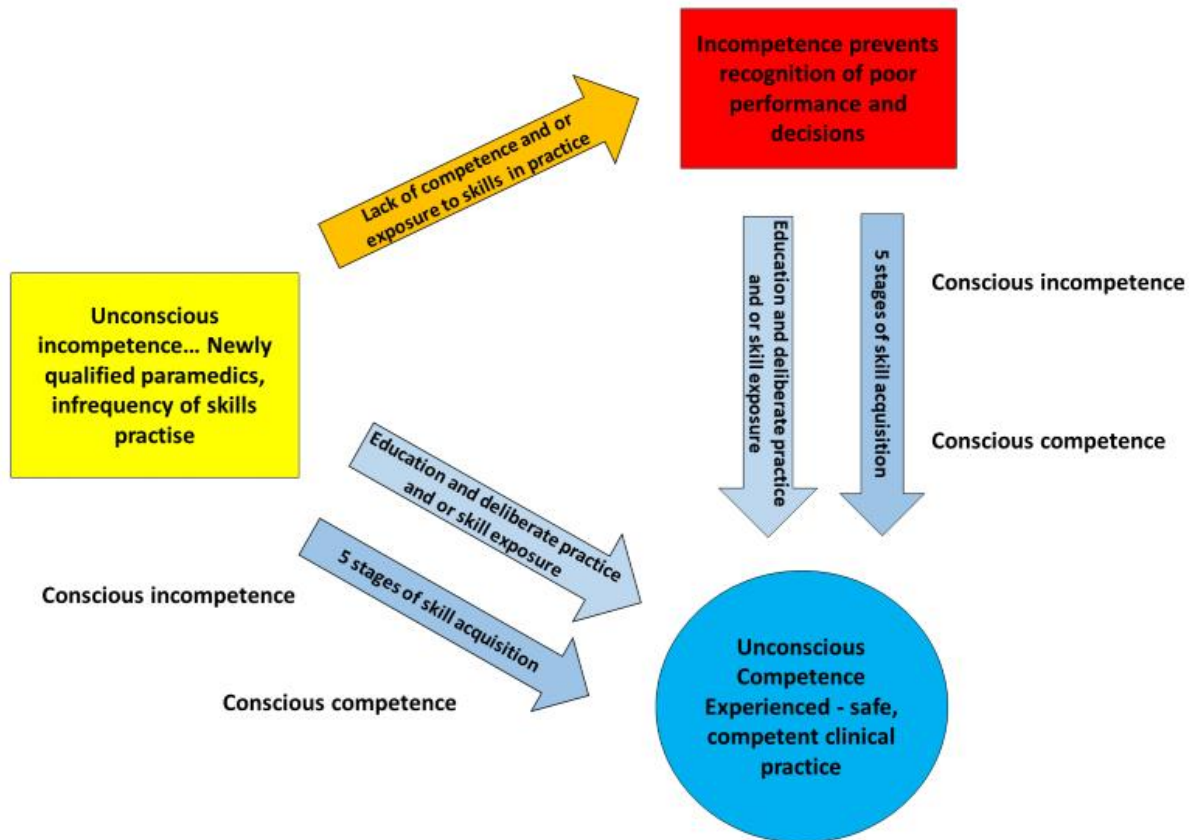


Figure 1.3, Factors for Competence in Clinical Practice

Some of the theories/content mentioned above suggest that insight is not necessarily within the control of the individual. However, it may be gained through reflection which can be thought of as the process of considering something deeply through analysis and questioning, in order to develop practice (Johns, 2006). The reflective process enables identification of learning needs and gaps in knowledge that would potentially help to avoid the Dunning-Kruger effect or move on past being unconsciously incompetent. Thus, reflection may be a practice solution to address unconscious biases and perceptions, indeed it is part of 'deliberate practice'. However, it is firstly important to determine whether effects such as the Dunning-Kruger effect exist in paramedic practice or whether paramedics' perceptions about

practice performance reflect their actual performance. This will be the focus of chapter 5.

### **1.5 Aims & Objectives of the Study**

This thesis will identify incidents attended and skills commonly used within UK paramedic practice. It will then look to observe performance of clinicians carrying out these skills as well as exploring clinicians' impressions of their own ability and the inter-relationship between actual and perceived performance.

#### *Aims*

More specifically the aims of the study was to:

- Develop a map of incidents attended and skills commonly used in one UK ambulance service
- Assess the performance of clinicians across different types of skills
- Exploring clinicians' perceptions of their competence and confidence in relation to their objectively assessed performance.

#### *Objectives*

The above aims were addressed through the following objectives:

1. Identify infrequently practised skills/procedures within a large UK Ambulance Service Trust (chapter four)
2. Ascertain whether factors such as geographical location or previous experience are associated with skills practiced by paramedics (chapter four)

3. To compare competence, and perception of competence, in paramedics using a defined set of skills (chapter five)
4. To examine factors associated with competence and perception of competence (chapter five & six)
5. Identify organisational issues that are created by the growing skill set for paramedics (chapter six & seven)

### *Outcome*

The overall purpose of this thesis is thus to provide information about the required current skill set of qualified paramedics, their actual and perceived performance in skills to help inform a discussion about whether training and education are currently “fit for practice”. The outcome of the thesis will be therefore to propose solutions to any identified gaps in skilled performance from both a clinical and an organisational perspective.

## **1.6 Structure of the Thesis**

In chapter two the evidence related to paramedic skills performance and the competence/confidence of paramedics is reviewed in a systematic manner. This informed the methods used in the two phases of the thesis. In chapter three the methodological approach and the research methods used to achieve the aims/objectives are presented.

Results for each phase are presented separately in Chapters four and five and a brief discussion of the results is provided at the end of each chapter. The overall results are then synthesised and critiqued in the context of previous studies in chapter six.

Finally, chapter seven provides a conclusion of the thesis, exploring strengths and limitations of the study as well as highlighting impact on various areas of paramedic practice such as education and making recommendations.

## **1.7 Summary**

This chapter has highlighted the complex, broad nature of the contemporary paramedic role within the UK. It has offered an insight into the history of ambulance services and the rapid development of the paramedic role, citing various drivers such as demand on the NHS, that have brought about these changes.

The environment described has meant that paramedics in the traditional role are practising a skill-set wider than ever before; in addition, it is one that is still developing and exists within a dynamic working environment. This creates some issues related to both the quantity of skills and the degree to which paramedics are able to practice them. This is highlighted in the literature that cites issues with forgetting skills that are not regularly used, it also poses that people may struggle to demonstrate insight into their own performance, believing that they are more competent than they actually are.

This study aims to establish the skills that are commonly used by paramedics in the UK and to explore clinicians' perception of their own performance.

## **Chapter Two: Literature Review**

### **2.0 Introduction**

Reviewing the literature is a vital part of any research journey; it enables identification of the key themes around topics, and can guide discussion and consideration of the data collected during the research process.

This chapter, will detail the approach taken in this study, detailing the search strategy and rationale for the eligibility criteria applied to the review. The literature identified through the search will be listed in tabular form, prior to more in-depth consideration of the evidence relating to paramedic skills performance and competence/confidence.

### **2.1 Decisions about Reviewing the Literature**

In order to make and inform future decisions about this study and its design, a scoping review of the literature was conducted to examine;

- paramedic Skill-set
- Incident/Skill Frequency
- Competence/Confidence

The original intention was to conduct systematic review; however, early exploration of the literature demonstrated that it would be inadequate to use this approach due to the available quantity and quality, in terms of the hierarchy of evidence. It was decided that an approach taking a broader view of the topic, such as the above mentioned scoping review, would be more beneficial (Arksey & O'Malley, 2005; Daudt, van Mossel & Scott, 2013; Levac, Colquhoun & O'Brien, 2010; O'Brien,

Colquhoun, Levac, Baxter, Tricco, Straus, Wickerson, Nayar, Moher & O'Malley, 2016). Such an approach did not seek to critically analyse the available evidence, rather to identify or 'map' the existing literature in a broader sense (Arksey & O'Malley, 2005; Levac, Colquhoun & O'Brien, 2010).

In a web-based survey exploring the advancing methodology behind this approach, participants described the process as less rigorous than a systematic review but more so than a traditional literature review (O'Brien *et al.*, 2016). Furthermore, a scoping review looking at consistency of this approach identified that this is a review method growing in popularity (Pham, Rajić, Greig, Sargeant, Papadopoulos & McEwen, 2014).

## **2.2 Scoping Reviews**

Scoping reviews can be particularly relevant when used to explore broad areas of practice with emerging evidence, where there are a lack of randomised controlled trials (RCT) that would be used in systematic reviews (O'Brien *et al.*, 2016). This is very fitting in the case of paramedicine, given the rapid development of practice and broad nature of the profession, already highlighted in chapter one, as well as a lack of relevant RCTs.

Early literature around scoping reviews suggested four potential reasons for using this approach: to see what literature exists already, to determine the value of undertaking a systematic review, to summarise and disseminate research in a specific area and finally, to identify gaps in the evidence base (Arksey & O'Malley, 2005). Subsequent authors have asserted that there is a lack of clarity within the four broad reasons offered for choosing a scoping review (Levac, Colquhoun & O'Brien, 2010). Regardless, the author felt that this approach would help to identify



the range of research activity that already exists in relation to this area of interest as well as helping to identify gaps in the current evidence base (Arksey & O'Malley, 2005).

Scoping reviews are a popular alternative to systematic reviews and in addition to a different approach, they also elicit different results. Systematic reviews tend to look in detail and depth at a focussed number of empirical studies, using a detailed research question; the scoping review however, will look at a broader range of studies that don't necessarily relate directly to a specific research question and will not examine the methodological quality (Arksey & O'Malley, 2005). Regardless of the differences in this methodology it is vital that a scoping review is still carried out in a rigorous and systematic way (Arksey & O'Malley, 2005; Daudt, van Mossel & Scott, 2013; Levac, Colquhoun & O'Brien, 2010). Although there is various literature pertaining to the structure and process of scoping reviews, there is still no universal definition; generally, scoping reviews are defined as mapping a range of literature and methodologies (Levac, Colquhoun & O'Brien, 2010).

### **2.3 Search Strategy**

It was initially considered important to look at UK practice only, as this aligned with the initial plans and ideas for the study; however, it became apparent that this would limit the evidence considerably, so the search was widened to include international literature also. Various time limitations for the literature review were considered but similarly to the issue of geographical origin, the initial plan of five years was increased to ten to ensure that relevant literature was identified. This was felt to strike the right balance between finding relevant articles and remaining contemporary. The search period therefore spanned 2005-2015, when initially

conducted in 2015, a period where paramedics had always been registered healthcare professionals. This search was later updated in 2020. The need to make these decisions when searching for the literature is important and is highlighted by the scoping review literature in the context of the importance of identifying relevant documents (Arksey & O'Malley, 2005; Levac, Colquhoun & O'Brien, 2010).

In relation to skills, the decision was taken to concentrate on the core skill-set of a UK paramedic. Much is written about the evolving roles of specialist paramedics but the original aims had always been to include the traditional, entry-level skills, not those that were considered the domain of specialist practice.

Using developing research questions around paramedic skills and skill-sets, incident/skill frequency and confidence and competence, and with guidance from a subject specific librarian at the University of Plymouth, search terms were identified for interrogation of literature databases. The use of subject specific librarians to optimise the validity of a search has been previously identified as good practice for scoping reviews in a literature review exploring the advance of the use of this methodology (Daudt, van Mossel & Scott, 2013). The search terms logically fell under three broad categories as can be seen in table 2.1.

### **2.3.1 Search Terms, Databases and Sources**

The final search terms related to paramedic skill/incident frequency, competence/competence and skill-set can be seen in see table 2.1. Boolean operators were used during the search to ensure that relevant literature was not missed and that the results were focussed.

Table 2.1 Search Terms

<b>Search 1</b>	<b>Search 2</b>	<b>Search 3</b>
<b>Paramedic Skill-Set</b>	<b>Incident/Skill Frequency</b>	<b>Confidence/Competence</b>
“Skill set”	“Incident frequency”	Confidence
“Core skills”	“Common skills”	Competence
“Skill expansion”	“Regular calls”	“Skill decay”
“Clinical skills”	“Incident type”	“Skill redundancy”
“Paramedic skills”	“Skill usage”	“Dunning Kruger”
“Scope of practice”		

In order to achieve the above, the following common terms were used in conjunction with those presented in table 2.1;

- UK/United Kingdom/GB/Great Britain
- paramedic\*
- Ambulance Service or Prehospital

The search was carried out using the NHS/NICE/Open Athens evidence website. The following databases were interrogated:

- AMED
- BNI
- CINAHL
- EMBASE
- Medline
- PsycINFO

Search terms were inputted individually in to each of the various databases, to make allowances for the subtle differences in the way that they look for articles. In addition, the system thesaurus was used to ensure that linked terms, and therefore potentially valid articles, were not missed.

The grey literature was also searched through interrogation of websites. This is an important process to ensure that relevant information is included (Gray, 2013).

Literature from the following organisations was searched;

- Department of Health
- National Institute for Clinical Excellence
- College of Paramedics
- Health and Care Professions Council

To make sure that sources in obscure locations were located, ‘snowball’ searching was also utilised (Gray, 2013; Greenhalgh & Peacock, 2005).

The database searches carried out were saved and fortnightly alerts set up so that newly published articles could still be included within this study. The search was also updated in 2020 as well as informally during various stages of this study such as writing the discussion.

### **2.3.2 Literature Selection (PRISMA ScR Chart)**

The selected literature can be reviewed in an adapted PRISMA chart, figure 2.1.

This shows the selected studies as a whole but also in the context of the broad categories mentioned above; however, some of the identified literature aligned to more than one of the broad categories and therefore the category totals do not equate to the overall total. The selected literature will be explored in the context of

various themes, as is a stated benefit of this approach in the scoping review literature (Arksey & O'Malley, 2005).

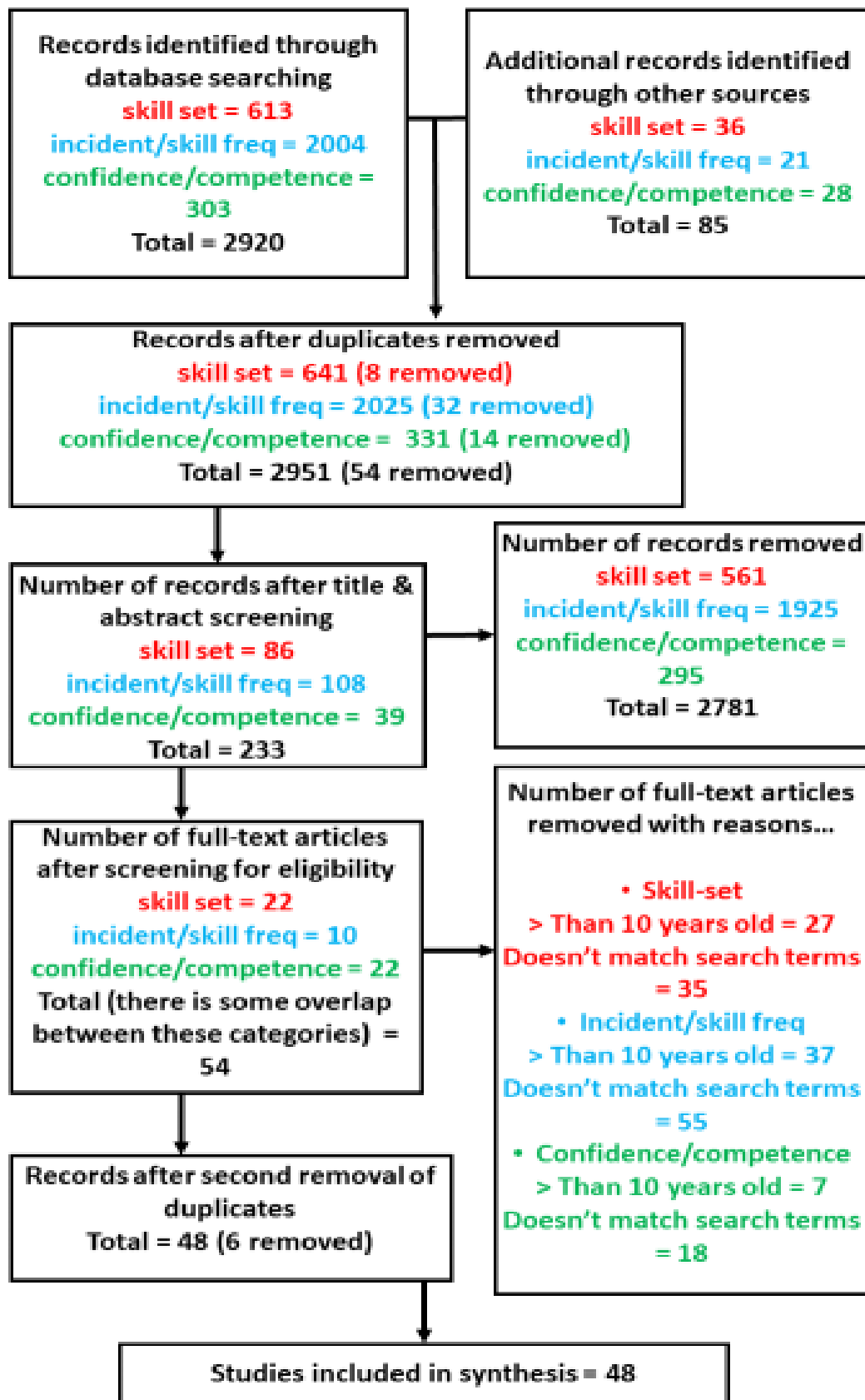


Figure 2.1, Adapted PRISMA-ScR Chart for the Literature Selection (Tricco, Lillie, Zarin, O'Brien, Colquhoun, Levac, Moher, Peters, Horsley & Weeks, 2018)

### **2.3.3 Results of the search strategy**

The search identified a total of 48 documents, including 22 for 'Paramedic skill-set', 22 for 'Confidence/competence' and 10 for 'Incident/skill frequency', with some overlap between categories.

Following on from the search and selection processes, table 2.2 identifies the characteristics of the literature found, it utilises a model adapted from a discussion piece regarding scoping reviews (Armstrong, Hall, Doyle & Waters, 2011).

**Table 2.2 Characteristics of the Included Literature**

<b>Authors/ Year/ Location</b>	<b>Title</b>	<b>Study Population /Focus</b>	<b>Study Aims</b>	<b>Methods</b>	<b>Outcome Measures</b>	<b>Results/Conclusions</b>
AACE (2011) UK	Taking Healthcare to the Patient 2: a review of 6 years' progress and recommendations for the future	Paramedicine	To report on progress with recommendations from a previous review of UK ambulance services	Report	N/A	Good progress has been made since the previous report but the ambulance service is still developing and there is lots more to do
Benbasset et al (2005) Israel	Viewpoint: Suggestions for a Shift in Teaching Clinical Skills to Medical Students: The Reflective Clinical Examination	Medics	To propose changes to the way medical student are taught clinical examination – introducing the reflective examination	Opinion Piece	N/A	Future research comparing a traditional physical examination with the reflective examination is required
Benger et al. (2018) UK	Effect of a strategy of a Supraglottic airway device vs tracheal intubation during out-of-hospital cardiac arrest on functional outcome: the AIRWAYS-2 randomized clinical trial	Paramedicine	To determine whether a supraglottic airway device (SGA) is superior to tracheal intubation (TI) as the initial advanced airway management strategy in adults with non-traumatic out-of-hospital cardiac arrest	Cluster RCT	Modified Rankin Scale score at hospital discharge or 30 days after out-of-hospital cardiac arrest	Outcomes were not improved for patients who received airway management with a specific type i.e. endotracheal tube or laryngeal mask airway.



Barelli & Scapigliati (2010) International	The four-stage approach to teaching skills: The end of a dogma?	Medics /Nursing	N/A	Editorial	N/A	The four stage teaching approach lacks evidence but should continue to be used until more research is done
Bradley (2005) UK	Taking healthcare to the patient: transforming NHS ambulance services	Paramedicine	To provide a strategic review of ambulances services in the UK	Report	N/A	Paramedics need to develop their skills and education to deliver the service needed by patients
Byrne, Pugsley & Hasham (2008) International	Review of comparative studies of clinical skills training	Paramedicine /Medics/ Nursing (n=903)	Compare methods used to train people to carry out clinical skills	Systematic Review	N/A	Teaching methods have little impact on clinical skills but opportunities to practice do
Carraccio et al (2008) International	From the educational bench to the clinical bedside: translating the Dreyfus developmental model to the learning of clinical skills	Medicine	To integrate knowledge and beliefs about practicing clinical medicine into a framework using the Dreyfus and Dreyfus model of skill acquisition	Literature Review	N/A	The journey of self-directed learning is unique and as such an individualised, tailored approach is required to make 'good doctors'.
Chalk, Black & Pitt (2016) UK	Which factors most influence demand for ambulances in South West England?	Paramedicine	To explore factors that influence ambulance service demand	Mixed Methods	N/A	Elderly falls and mental health patients are significantly increasing demand on ambulance services

Cleary and Sanders (2011) UK	Assessing self-regulatory processes during clinical skill performance: A Pilot Study	Medicine (n=7)	To evaluate the use of Self-Regulated Learning microanalysis, and its impact on venepuncture skill in students.	Pilot Study – Evaluative survey	Success in IV cannulation	Students who engaged in SRL were more successful when attempting IV cannulation on a simulated arm.
Cooper (2005) UK	Contemporary UK paramedical training and education. How do we train? How should we educate?	Paramedicine	Develop understanding of current and future paramedic training/ education within a large UK ambulance trust	Qualitative naturalistic enquiry	N/A	Ambulance services are in a transitional stage and development issues are part of an emerging profession
CoP (2017) UK	Paramedic Curriculum Guidance (4 <sup>th</sup> edn)	Paramedicine	To provide HEIs with guidance for the structure /content of UG paramedicine programmes	Guidance Document	N/A	N/A
CoP (2018) UK	Paramedic - Scope of Practice Policy	Paramedicine	N/A	Policy	N/A	N/A
CoP (2018) UK	Post Registration - Paramedic Career Framework (4th edition)	Paramedicine	Provide information on the four pillars of career pathways for paramedics	Guidance Document	N/A	N/A
Evans et al. (2014) UK	Which extended paramedic skills are making an impact in emergency care and can be related to the UK paramedic system? A systematic review of the literature	Paramedicine	To identify evidence of paramedics trained with extra skills and the impact of this on patient care and interrelating services such as General Practices or Emergency Departments	Systematic Review	N/A	Many extended skills are identified but the evidence for use of these is not strong enough to guide policy.

Garside & Nhemachena (2013) UK	A concept analysis of competence and its transition in nursing	Nursing	To present findings from a concept analysis that explored facets of competence, particularly within nurse education in the United Kingdom	Systematic Review	N/A	A universally agreed definition of competence is unlikely within nursing, this is partly due to the large number of differing definitions in existence.
Grief et al. (2010) Switzerland	Emergency skill training—A randomized controlled study on the effectiveness of the 4-stage approach compared to traditional clinical teaching	Medicine (n=128)	To evaluate whether skill training with the 4-stage approach results in shorter performance time needed for a successful percutaneous needle-puncture cricothyroidotomy, and consequently in a reduced number of attempts needed to perform the skill in	RCT single-blinded parallel group study	Performance time in performing the clinical procedure	Using the 4-stage approach to teaching, or adaptations of this method, do not seem to offer any performance advantage.
HCPC (2014) UK	Professionalism in healthcare professionals	Healthcare Professionals	To increase understanding of professionalism within three HCPC regulated professions (chiropractors / podiatrists, occupational therapists and paramedics)	Qualitative study using focus groups	N/A	Professionalism is not perceived as an absolute, but constructed in the interaction of individual and context.

HCPC (2015) UK	Preventing small problems from becoming big problems in health and care	Healthcare Professionals	Review literature related to competence in relation to healthcare professionals	Research Report – Literature review, retrospective analysis of FTP cases and interviews	N/A	Engagement has the potential to impact on competence and therefore practice; support, supervision and workload are key factors that play a role in this relationship.
HCPC (2018) UK	HCPC decision on threshold level of qualification for paramedics	Paramedicine	To explain the decision to change the threshold level for entry to the register	Online news Release – HCPC website	N/A	N/A
Herbert (2005) US	Hyposkillia. Deficiency of Clinical Skills	Medics	N/A	Editorial	N/A	Advances in technology have been to the detriment of medical students' clinical skills.
Kennedy, Kenny & O'Meara (2015) International	Student paramedic experience of transition into the workforce: a scoping review	Paramedicine (articles identified – n=11)	To present the findings of a scoping review into the transition from education to practice for paramedics	Scoping Review	N/A	The transition from student to practitioner is a stressful one as a result of contemporary role demands. Also highlighted it a lack of research in the area
Kirby, Moreland & Pollard (2016) UK	The impact of working shifts: exploring the views of UK paramedics	Paramedicine (n=11)	Explore the effects of shift work on paramedics	Qualitative – Focus groups	N/A	Shift work can have a negative impact on a paramedic's working environment.

Kneebone et al. (2007) UK	Complexity, risk and simulation in learning procedural skills	Health Professionals	Propose a structure approach to procedural training	Narrative Review	N/A	This paper argues for a structured approach to procedural skills training, maximising learning despite reduced clinical exposure.
Laker and Powell (2011) International	The differences between hard and soft skills and their relative impact on training transfer	Human Resources	To offer an alternative perspective to a theoretical and practical interest in training transfer	Literature review	N/A	'Soft' skills do not transfer from training to practice as well as 'hard' skills do
Lauria et al. (2017) US	Psychological Skills to Improve Emergency Care Providers' Performance Under Stress	Paramedicine	To describe performance enhancing psychological skills	Literature Review	N/A	Stress can be damaging to performance. Performance enhancing Psychological skills can help address this
LeBlanc (2009) US	The Effects of Acute Stress on Performance: Implications for Health Professions Education	Health Professionals	To review research on the impact of acute stressors on the clinical performance of individuals and teams	Literature Review	N/A	There would be value in training future health professionals in stress management techniques

Lovegrove & Davis (2013) UK	Paramedic Evidence Based Project (PEEP) End of Study Report	Paramedicine	To develop an evidence based business case to progress the strategic direction for the standardisation of education and training for paramedics.	Structured/se mi-structured interviews and focus groups – thematically analysed	N/A	Entry to the professional register should be increased to BSc to reflect the complexity of the role. Skills should be developed to address the needs of service users
Lukasik et al. (2019) Finland/US	The relationship of anxiety, stress and depressive symptoms with working memory performance in a large non-depressed sample	General Public	To assess association between working memory and everyday stress	Mixed Methods	Working memory task scores. Stress scores	The impact of everyday stress on working memory is limited
Michaels, Evans & Block (2012) UK	What is a clinical skill? Searching for order in chaos through a modified Delphi process	Medics	Explore concepts around the definition of a Clinical Skill and its components for learning and teaching.	Delphi Study	N/A	Clinical skills can have several domains. Learning a clinical skill involves knowing how, why the skill would be used and what the outcomes might mean
Moran (2016) US	Anxiety and working memory capacity: A meta-analysis and narrative review	General Public	Critically evaluate the evidence for anxiety-related deficits in working memory capacity	Meta-analysis and narrative review	Working memory task scores. Stress scores	Anxiety is linked to poor performance.

Murray et al. (2005) US	A Simulation-Based Acute Skills Performance Assessment for Anaesthesia Training	Nursing /Medicine	To measure the performance of student nurse anaesthetists and resident physician trainees in managing the high acuity patient	Experimental	Scores from an evaluated simulated patient	Assess of the ability of medical professionals to manage high acuity patients is difficult. A simulation based assessment strategy could help address this
NAO (2010) UK	Major trauma care in England	Medicine /Nursing /Paramedicine	To evaluate major trauma services in the UK and what improvements need to be made	Report – Analysis of TARN data, telephone interviews and semi-structured interviews	N/A	There is significant variation in trauma care across the UK, this should be made more uniform, using trauma networks
NCEPOD (2007) UK	Trauma: Who Cares?	Medicine /Nursing /Paramedicine	To examine the process of care for severely injured patients and identify variations that affect the achievement of agreed endpoints.	Mixed Methods study	N/A	The trauma care provided to critically injured patients does not meet the standards expected of the NHS
Orde, Selenza and Pinder (2010) Australia	A randomised trial comparing a 4-stage to 2-stage teaching technique for laryngeal mask insertion	Medicine/ Nursing	To compare efficacy of the 4-stage and more traditional , 2-stage teaching approach	Prospective randomised study	Time to place a laryngeal mask airway	There is no statistical difference between the 4-stage and traditional 2-stage teaching approach.

Pusic et al. (2012) International	Experience curves as an organizing framework for deliberate practice in emergency medicine learning	Medicine	To demonstrate experience curves – longitudinal acquisition/decay of skill over time	Literature Review	N/A	Deliberate practice will help to longitudinal learning
Pusic, Pecaric & Boutis (2011) US	How Much Practice Is Enough? Using Learning Curves to Assess the Deliberate Practice of Radiograph Interpretation	Medicine (n=38)	To demonstrate how learning curves can describe proficiency improvements associated with deliberate practice of radiograph interpretation.	Prospective Cross-sectional Study	Accurate interpretation of a series of radiographs	Deliberate practice of radiograph interpretation enables medical educators to define when practice is most efficient and how much practice is required to achieve a level of mastery.
QAA (2016) UK	Subject Benchmark Statement Paramedics	Paramedicine	Provide guidance for HEI programmes regarding programme content and structure	Benchmark Statement	N/A	N/A
Roberts et al. (2005) UK	A review of emergency equipment carried and procedures performed by UK front line paramedics on paediatric patients	Paramedicine (n=22 ambulance trusts)	To assess national practice on paediatric patients.	Questionnaire	N/A	There should be standardised practice by paramedics for paediatric patients in the UK



Robinson (2017) UK	A student perspective: newly qualified paramedic programme	Paramedicine	Review the Newly Qualified Paramedic (NQPP) programme	Literature Review	N/A	The NQP programme is a positive thing but further research should be done into its length and other settings such as GP practices
Ryan & Halliwell (2012) UK	Paramedic decision-making—how is it done?	Paramedicine	Consider the difference between graduate and IHCD paramedics when decision making	Combination of Mixed Methods and a Case Study approach with Phenomenology and Hermeneutics	N/A	Decision making will likely be dictated by the incident and experience. Adoption of a hypothetical-deductive model safeguards the patient/clinician better than use of intuition as it takes into account the relevant evidence.
Sanson-Fisher, Rolfe & Williams (2005) Australia	Competency based teaching: the need for a new approach to teaching clinical skills in the undergraduate medical education course	Medicine	To demonstrate that undergraduate medical courses are failing to provide students with adequate training in the area of clinical skill	Literature review	N/A	Doctors lack adequate clinical training. A system to identify the needs of individuals is required to improve skills performance.
Schalk et al (2010) US	Out-of-hospital airway management by paramedics and emergency physicians using laryngeal tubes	Paramedicine/ Medicine	Evaluation of the feasibility of laryngeal mask airways in prehospital cardiac arrest	Questionnaire	Time to place the airway. Number of attempts	Laryngeal mask airways are a reliable tool to use in the prehospital setting for airway management

Shepard et al. (2008) UK	Medical undergraduates' competence and confidence in basic life support skills: an observational study of subjective and objective assessments	Medicine	To establish whether students are able to self-assess confidence /competence in the context of actual performance	Experimental Study	Actual assessment scores Self-reported confidence and competence scores	Moderate correlation exists between self-reported confidence /competence.  Students performed better than they thought they would
Shields (2011) UK	Paramedic non-technical skills: aviation style behavioural rating systems	Paramedicine	To review the introduction of non-technical skills and the benefits that this could have for paramedic practice	Literature Review	N/A	Development of non-technical skills have been shown to reduce risk and adverse events; introducing similar for paramedics would likely show the same benefits.
Shields & Flin (2013) UK	Paramedics' non-technical skills: a literature review	Paramedicine	To review the literature on paramedic non-technical skills	Literature Review	N/A	There would be benefit in identifying paramedic non-technical skills
Syme-Grant, Sterwart & Ker (2005) UK	How we developed a core curriculum in clinical skills	Medicine	To describe the process used to develop /maintain a clinical skills curriculum	Descriptive Report	N/A	The Process ensures a consensus derived curriculum, sensitive to changes in clinical material being taught.

Taylor et al. (2016) UK	Design and implementation of the AIRWAYS-2 trial: A multi-centre cluster randomised controlled trial of the clinical and cost effectiveness of the i-gel supraglottic airway device versus tracheal intubation in the initial airway management of out of hospital cardiac arrest	Paramedicine  Patient sample requirement - n=9070	A paper discussing the design and implementation of a study to assess the clinical effectiveness of the I-Gel supraglottic airway device	Protocol paper	Modified Rankin Scale score at hospital discharge or 30 days after out-of-hospital cardiac arrest	N/A – no conclusions yet drawn
Thompson (2015) UK	The perceived concerns of newly qualified paramedics commencing their careers: a pilot study	Paramedicine (n=4)	To identify perceived concerns of newly qualified paramedics and how they might be best addressed	Pilot Study	N/A	Newly qualified paramedics have a good knowledge base but lack confidence and need support from more experienced colleagues

## **2.4 Review of Literature**

Review of the literature identified seven themes: Clinical skill definition, learning clinical skills, ongoing development of clinical skills practice, the paramedic skill-set, incident/skill frequency, confidence/competence and Skill Performance, Competence/Confidence and Retention. Key information from these are now presented below.

### **2.4.1 Clinical Skill Definition**

There is much literature in relation to clinical skills in general; however, it is largely focussed on nursing and medicine; in addition, the term 'clinical skill' is nebulous and considered different things by different people, with no single consensus (Michels, Evans & Blok, 2012).

An Australian review paper offers a broad vision of clinical skills, albeit focussed on medicine; suggesting that clinical skills include history taking, physical examination, differential diagnosis, preventative issues, psychological/ethical/legal issues and investigation and management plan making (Sanson-Fisher, Rolfe & Williams, 2009). In a paper discussing the development of a medical curriculum using a Delphi process, three authors from a Scottish medical school stop short of offering a definition, but within their medical curriculum and teaching do differentiate between a clinical skill and a practical procedure, unfortunately they do not offer any differentiation between these terms (Syme-Grant, Stewart & Ker, 2005).

An international study employing a modified Delphi process to ask, "What is a clinical skill?" used doctors (n=22 in the initial round) with involvement in teaching clinical skills. The paper made various interesting observations in relation the concept of clinical skills and what they are. Despite some lack

of consensus it identified common domains of clinical skills with a high level of agreement (Michels, Evans & Blok, 2012), these were as follows; physical examination skills, practical procedures, communication skills, treatment/therapeutic skills.

These results show similarities with the study by Syme-Grant, Stewart and Ker. Between 90-100% of all participants agreed with these domains, interestingly, fewer participants (75%) considered that there is any interaction between the domains. However, procedures as well as knowledge and clinical reasoning were all identified as components of clinical skills that were found to cut across the domains mentioned above, this feels somewhat contradictory (Michels, Evans & Blok, 2012).

This concept of various domains can be seen in other literature. A commentary written by an international group of authors discusses clinical skills in the context of physical examination, clinical reasoning and diagnostic skills (Benbassat, Bauml, Heyman & Brezis, 2005). In further comment regarding individual domains, much of the literature positions them in isolation; however, some authors propose that these domains do not exist in isolation and there can be crossover (Benbassat *et al.*, 2005).

A literature review by Pusic *et al* (2012) exploring learning curves and emergency medicine, discusses kinaesthetic and cognitive skills. Reading an x-ray would constitute a cognitive skill and performing a needle cricothyroidotomy would constitute a kinaesthetic skill. Demonstrating the crossover between domains mentioned above, the authors say that it is possible to have a combination of both cognitive and kinaesthetic, such as in leading the resuscitation attempts of a patient (Pusic *et al.*, 2012); a skill of particular relevance for paramedicine. This view of practice and skills perhaps best

reflects the environment in which paramedics practice: unpredictable and subject to change (CoP, 2019; Lovegrove & Davis, 2013). Combinations of the domains discussed above are not always entirely compatible but do serve to demonstrate the complexity of defining and categorising clinical skills.

#### **2.4.2 Learning Clinical Skills**

Teaching clinical skills is complex, two Australian authors carried out a review of the way they are taught to medical students. It highlighted that teaching of skills is often carried out in a practice setting, making it opportunistic or even non-existent given the contemporary pressures that exist within healthcare such as increasing workloads (Sanson-Fisher, Rolfe & Williams, 2009). Although this review did not look at paramedicine, the unpredictable nature of placements is highly relevant to paramedic practice (CoP, 2019). An American guest editorial in a cardiac journal expanded further on issues with skills training suggesting that technology had reduced the need for American medical students to master traditional clinical skills such as history taking and physical examination (Herbert, 2005); this could perhaps be argued of paramedic students in recent years with the introduction of more advanced monitoring equipment including electronic patient clinical records, that provide clinical prompts and information about previous attendances.

Regardless of where clinical skills are taught, generally a behaviourist model would seem to fit teaching of the isolated motor skill best, this sees learning as a change in behaviour bought about by repetition, practise and feedback (Michels, Evans & Blok, 2012). The behaviourist model aligns well with clinical simulation (Hope, Garside & Prescott, 2011). In a study involving pre-registration nurses (n=500) from the UK, researchers undertook thematic

analysis of post simulation evaluation questionnaires, using the data to inform focus groups (Hope, Garside & Prescott, 2011). Findings showed that students felt simulation prepared them well for practice and also gave them confidence as well as helping development of psychomotor skills.

This approach perhaps becomes more limited when we start to consider clinical skills in the wider, less simplistic context, including cognitive elements such as communication and clinical reasoning for example.

Consideration of cognitivism perhaps addresses this with its acknowledgement of a more in depth, active process with active involvement of the mind in the learning of skills through problem solving and analysis (Ertmer & Newby, 1993), rather than the simple observation of behaviour, and therefore appreciation of a deeper element than plain motor involvement. Both of these address relevant elements individually but seem lacking overall.

Constructivism has its roots in the works of the psychologist, Jean Piaget and builds on the cognitivism concept. It holds a slightly different standpoint again and offers a better fit with the idea of learning clinical skills in the broader sense. It suggests that students construct their own learning through experience and reflection. As they experience more they reconcile their understanding/knowledge or discard the new information as irrelevant (Ertmer & Newby, 1993). Although this perhaps better reflects the complexity of learning, it does support the issues with placement unpredictability previously raised (Sanson-Fisher, Rolfe & Williams, 2005).

There is an assertion made that knowledge can be considered under three categories; declarative (factual), procedural (how) and conditional (when/why) (Seok, Meyen, Decosta & (eds), 2010). In relation to clinical skills and their domains, confusion exists as to whether they relate solely to procedural

knowledge or should be integrated with declarative and/or conditional (Michels, Evans & Blok, 2012). Given the literature already discussed, common sense would suggest that a combination of all is required in order to recognise the need for a clinical skill to be performed, the knowledge of how to do it and at what point. Regardless of the combination required, the authors are clear that careful consideration of what components are being addressed for a given domain are vital in order that the learning is a success.

Paramedics in the UK currently have varying education backgrounds due to recent changes within the profession (Lovegrove & Davis, 2013); however, all education of paramedics involves placement in one form or another.

A cross-sectional survey looking at placement experience and skill development, consisting of student nurses (n=421) in the UK, found that it allows students to link theory to practice; in addition, it enables development of clinical skills. In relation to nursing programmes, it did however highlight that the quality of experience and learning would depend on communication between the educational provider and the placement area (Stayt & Merriman, 2013). This links to the importance of the initial 'encoding', the act of getting information into the memory, when learning a new skill, the better the 'encoding', the more ingrained a skill will be (Pusic et al, 2012).

This discussion around learning theory and categorisation of knowledge serves to again demonstrate that clinical skills can be viewed in various different ways depending on what they involve; consideration of how they should be taught and maintained is therefore vitally important in terms of competence and confidence (Michels, Evans & Blok, 2012). Common key themes identified in the literature, for good practice in this area, seem to be quality simulation and placement with specific links made between these two components.



A model with a focus on initial teaching/learning of a clinical skill, is that of the '4-stage' approach, originally conceived by Peyton (Peyton, 1998). As the name suggests, the focus lies with the teaching method. This is broken into four parts; demonstration, deconstruction, formulation and performance.

This approach has been widely used in courses internationally by organisations such as the General Medical Council (London), University of Western Australia, American Heart Association and the European Resuscitation Council (Soar, Nolan, Böttiger, Perkins, Lott, Carli, Pellis, Sandroni, Skrifvars & Smith, 2015). It is suggested that by working through these steps the 'trainee' will move from conscious incompetence to conscious competence, ultimately achieving unconscious competence once the skill in question has been practised many times (Barelli & Scapigliati, 2010; Greif, Lars, Basciani, Lockey & Vogt, 2010; Orde, Celenza & Pinder, 2010; Soar *et al.*, 2015).

In an editorial piece for the journal of the European Resuscitation Council, the authors concluded that there was not specific evidence to support this approach but in the absence of such evidence, asserted it should continue to be used (Barelli & Scapigliati, 2010). A European single blinded randomised control trial with medical students (n=128) studied the effectiveness of the 4-stage approach in comparison to traditional teaching and an approach that removed various stages. They concluded that the 4-stage approach, as well as a modified version (with removal of either stage 2 - teacher performing task and commentating or stage 3 - teacher performing task and student commentating) did not show better performance than the traditional teaching model (Greif *et al.*, 2010). Similarly, a separate European prospective randomised study, consisting of nursing and medical students (n=120), compared the traditional teaching approach (the authors termed this the 2-stage approach) with the 4-

stage approach (Orde, Celenza & Pinder, 2010). Specifically they used laryngeal mask airway (LMA) insertion to measure this, the process of placing an adjunct over the top of the glottis to help maintain a patent airway. The authors concluded that there is no significant difference between the two teaching methods in their success.

Two studies have tested the efficacy of teaching using this method. The one highlighted in the text above (Orde, Celenza & Pinder, 2010) and another looking at medical students and teaching them to carry out a cricothyroidotomy (Greif *et al.*, 2010). Both of these skills are practised by paramedics in the UK, the results suggested that there was no benefit over more traditional/basic teaching methods such as watching video footage prior to performing the skill multiple times, or missing out one of the four stages, which was not found to have a negative impact (Barelli & Scapigliati, 2010; Greif *et al.*, 2010).

A systematic review of comparative studies of clinical skills training, carried out by Byrne, Pugsley and Hashem in 2008 identified five papers. Broadly, these support the findings of the two trials above, concluding that work-based learning and repeated, spaced training opportunities do improve performance (Byrne, Pugsley & Hashem, 2008). A stand-out finding was, that by allowing paramedic students access to a twenty-six minute video clip of laryngoscopy several times following a traditional airway management course, increased overall success rates were identified in the skill, from 46% to 88% (Byrne, Pugsley & Hashem, 2008). A literature review looking at medical students clinical skills training found that there is an issue with the clinical skills performance of undergraduate medical students. The authors identified that the literature supported identification of individual learning needs of students and highlighted a particular model where an initial lone consultation and reflection followed by

observing a tutor led consultation with comparison of the two improved performance (Sanson-Fisher, Rolfe & Williams, 2009).

### **2.4.3 Ongoing Development of Clinical Skills Practice**

A commonly cited model with a focus on continued learning/development is the 'five stage model of skill acquisition' (Dreyfus, 2004). This model doesn't consider individual domains specifically and is generic in its nature, it charts a path from novice to advanced beginner and then competence before achieving proficiency and finally expertise; the latter stages of this model would not be achieved until time had been spent in practice, learning and gaining experience. Each of these stages involves a specific improvement on the previous and requires personal investment in order to advance; this said, movement within the model can be two way and it is possible for performance to deteriorate as well as improve. This concept is elaborated on further by Carraccio et al, who explore skill acquisition in the context of clinical medicine. They highlight that although this model is thought of in stages, it is actually a continuum and learners may be at different points for different skill-sets (Carraccio, Benson, Nixon & Derstine, 2008).

#### 2.4.4 The Paramedic Skill-Set

The HCPC Standards of Proficiency (HCPC, 2014) define scope of practice as;

*“The area or areas of your profession in which you have the knowledge, skills and experience to practise lawfully, safely and effectively, in a way that meets our standards and does not pose a danger to the public or to yourself.” (p.4)*

*(HCPC, 2014)*

The College of Paramedics Scope of Practice policy, references the HCPC in describing the very broad, wide reaching scope of practice for paramedics (CoP, 2018a). Although potentially frustrating for those seeking detail, this document recognises the previously mentioned broad nature of the profession and number of roles that paramedics can find themselves working in. The definition provided by the College is;

*“A paramedic is an autonomous practitioner who has the knowledge, skills and clinical expertise to assess, treat, diagnose, supply and administer medicines, manage, discharge and refer patients in a range of urgent, emergency, critical or out of hospital settings”. (p.6)*

*(CoP, 2018a)*

Neither of these really ‘pin’ down the actual skills practiced by paramedics. Within the context of standards of proficiency, the HCPC progress with this subject to state that scope of practice for professionals will change and evolve over time; they stipulate that registrants must continue to meet the standards of proficiency relevant to the position they hold. The first standard in this

document says that registrants must practise safely and effectively within their scope of practice (HCPC, 2014).

A broadening in scope of practice may occur as a result of developing service and patient needs, not just the registrant role and career progression (Bradley, 2005). The 'Bradley report' provided a strategic overview of ambulance service provision in the UK, it focussed on the need for a change to meet the contemporary (at the time) needs of its users, a key theme was that patients need to be attended by ambulance clinicians who have the skills/knowledge to complete their case or refer on if necessary (Bradley, 2005). Six years later, in 2011, a follow-up report was produced by the Association for Ambulance Chief Executives (AACE); specifically, it reviewed recommendations made in the 'Bradley report' and evaluated the progress with these. The document concluded that in the previous six years good progress had been made, largely as a result of the paramedic role development; however, it also acknowledged that there was still more to be done, indicating further development to come (AACE, 2011).

A systematic review of UK paramedic practice looked at the skills that make an impact, it looked at studies (n=19) and concluded that paramedics have the skill to successfully manage minor illness/ailments; however, it found a higher incidence of secondary contact within twenty-eight days, suggesting there may be some competence issues with this broadening of the scope of practice in that patients then have to seek further advice following consultation with paramedics; conversely, it may be indicative of worsening condition following consultation, thus causing the second contact. In addition, this review highlighted that paramedics encounter life threatening situations rarely (Evans, McGovern, Birch & Newbury-Birch, 2014). This consideration of minor

illness/injury and recognition that exposure to critical illness/injury is very infrequent demonstrates the broad and changing scope of practice for UK paramedics.

Both the reports mentioned above have recognised the increasing skill-set for paramedics operating in the traditional role, furthermore, they identify the need for education routes to reflect the demands of their role (AACE, 2011; Bradley, 2005). Advances in ambulance service clinical care have been noted, with the assertion that this has been largely achieved through improved education and training; in relation to preventing unnecessary admissions to hospital, paramedics in the local ambulance trust now offer some advanced management/pathway options such as provision of steroid tablets to asthmatic patients not conveyed to hospital, aspirin with immediate 'pathway' referral for low risk TIA patients and return of spontaneous circulation guidelines (AACE, 2011) as standard. These developments are all examples of situations where non-technical skills such as communication and clinical reasoning are primarily involved.

#### **2.4.5 Incident/Skill Frequency**

Various documents already mentioned in this scoping review have highlighted the frequency and infrequency of certain incident types and their associated skills. The two strategic reports on ambulance service provision (AACE, 2011; Bradley, 2005) raised the developing need for paramedics to be able to manage minor illness and injury and in contrast, the relative infrequency of critical illness/injury; both documents suggesting that these patient groups account for less than 10% of ambulance service workload. In a review of major trauma service provision carried out by the National Audit Office in 2010, it was

highlighted that major, life-threatening trauma actually accounted for less than 1% of the paramedics workload (NAO, 2010). Despite the previously discussed emphasis for ambulance services to re-direct focus towards urgent/primary care, it is however important remember that paramedics still have a responsibility to deliver quality care to this group of patients when the need arises.

In 2007 the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) published a study that used patient notes and questionnaires completed by clinicians to evaluate the quality of care provided to trauma patients in the UK. Conclusions for ambulance services were that there were some basic but serious concerns about the level of care provided, thus enforcing the point made above, that although exposure to this patient group is very infrequent, they still deserve the highest level of care (NCEPOD, 2007).

In a systematic review of the UK literature, the issue of an ageing population and increasing burden of chronic illness being faced by the NHS is raised; the literature suggests that paramedics are in a strong position to help with this situation, through reducing the number of attendances at hospital (Evans *et al.*, 2014). This is an assertion made previously in discussion around paramedics carrying out home visits (Bradley, 2005). Although the above seem intuitive as a direction for the profession and ambulance services, they often require a change in skill-set, to move from the traditional model to one where a wider range of services can be provided in a safe manner (Bradley, 2005).

Consideration of this and provision of patient safety must involve incident and skill frequency as well as complexity, the interplay between all have an impact on skill delivery (Pusic *et al.*, 2012).

#### **2.4.6 Skill Performance, Competence/Confidence and Retention**

Performance and retention of clinical skill are undeniably important to paramedic practice (HCPC, 2014; HCPC, 2018c; HCPC, 2018d). The specialist generalist nature of the profession means that incident types and therefore clinical skills practiced are sporadic/unpredictable in frequency (CoP, 2019); The trajectory of learning a new skill has been discussed in a literature review by Pusic et al, who identified the fast pace of initial learning before there is a slowing of performance improvement as competence is achieved, this trajectory has been termed the 'learning curve' (Pusic *et al.*, 2012). This was initially demonstrated in prospective, cross-sectional study consisting of training paediatric doctors (n=38), looking at their performance in reading ankle x-rays. The authors concluded the use of learning curves allowed them to identify at what point practice was most efficient (Pusic, Pecaric & Boutis, 2011).

Following on from the concept of 'learning curves' is that of 'experience curves' which chart the 'ebb and flow' of learning and forgetting. A literature review by Pusic et al identifies that skills not practised frequently will deteriorate at a very rapid rate initially, two factors said to be linked to this deterioration are identified in the review; firstly, the more complex the skill, the faster the deterioration and secondly, deterioration will be slower depending on the strength of the initial encoding. As mentioned earlier, encoding is the way information is initially processed by the brain when learning. Factors such as reduced attention will limit encoding whilst increased processing of the information will improve encoding (Baddeley, Eysenck & Anderson, 2009). Deterioration is said to limit itself to just above the level of a novice, rather than a total loss (Pusic *et al.*, 2012). A positive impact on skill performance and retention has been linked to regular opportunity to engage in independent practice with intermittent feedback



provided (Byrne, Pugsley & Hashem, 2008); this seemingly mitigates the downward trajectory of the forgetting curve, lessening its impact.

Self-regulated learning is a cyclical concept involving three sequential phases; forethought, performance and self-reflection (Zimmerman, 2010). Within this cycle, feedback and strategies can be used to maintain or improve performance. In a pilot study with a small number of medical students (n=7) performing intravenous cannulation on a manikin, it was shown that during the performance phase, if an individual exercises self-control tactics such as self-instruction, attention focussing and self-monitoring, performance can be optimised (Cleary & Sandars, 2011). The same paper identifies that 'strugglers', those who perform less well, are more often concerned with the outcomes rather than the process, intimating a more surface learning focus. More specifically, they were concerned with the drawing blood or the amount of pain they were causing rather than their execution of the skill as a whole. Within this study participants were also invited to self-evaluate their performance, those who struggled tended to have an inaccurately high perception of their own performance (Cleary & Sandars, 2011).

Competence is a key consideration when discussing clinical skill, it is often used as a measure of whether someone is safe to perform a clinical skill (HCPC, 2014), a generic, non-medical definition of competence is 'to do something successfully or efficiently'. Despite this, in the complex context of clinical practice, competence can still be difficult to define, a nursing focussed systematic review by Garside & Nhemachena looked at English language papers, using a thematic analysis to explore the concept of competence. It concluded that the number of different definitions compounds the problem of identifying what competence is; furthermore, it suggests that as a result of this,

it is unlikely that a universal definition will ever be accepted, suggesting that identifying incompetence is perhaps easier to identify (Garside & Nhemachena, 2013).

Another common confusion is that of competence and confidence, it is asserted that these are different, although inextricably linked. Whereas competence relates to the ability to complete a task or action, confidence relates to the belief in the ability to complete that task (Sanson-Fisher, Rolfe & Williams, 2005; Shepherd, Ambrose, Somerville & Ker, 2008). In an experimental study, UK medical student's self-rated confidence and competence on a Likert scale prior to participating in objective structured clinical examinations (OSCE), this data was then analysed with their assessment results to explore any correlation. Despite the differences above, there was moderate correlation between their self-reported competence and confidence; however, participants under-rated their own performance, consistently performing better than they thought they had (Shepherd *et al.*, 2008).

In the UK, newly graduated paramedics undergoing employment are required to undergo a period of consolidation (maximum two years) (Robinson, 2017). A literature review exploring the newly qualified paramedic experience, conclusion was drawn that it was a positive requirement that supported paramedics into practice. However, it does suggest that this provision needs to be explored for new graduates entering non-ambulance employment (Robinson, 2017).

The HCPC published a literature review looking at competence and healthcare professionals in 2015; the authors discussed the danger of concentrating on targets and efficiency rather than the patient (HCPC, 2015). The result of this is that a focus on ensuring competency in professions with a rapidly expanding skill-set may be lost by organisations. Additionally, and compounding this,

potential lack of support may cause clinicians to become overwhelmed as their workload and skill set increases; this in turn can cause them to become disengaged (HCPC, 2015). It raises several disengagement triggers that may negatively impact competence, including operating outside of their scope of practice and under-utilisation of skills. The review asserted that more research into enablers and barriers was required so that disengagement by healthcare professionals could be identified and addressed earlier.

The current paramedic profession has a workforce split between those who came into the profession via a university programme and those who completed a more vocational course. Belief has long been held that the traditional, vocational training focussed too heavily on resuscitation, trauma management and pattern recognition, whereas contemporary education should focus on mobile urgent care and effective decision making for example (AACE, 2011; Bradley, 2005; CoP, 2019). In 2013 Lovegrove and Davis created what they describe as an evidence based report on the standardisation of training and education of paramedics in the UK; this report was commissioned by the College of Paramedics. The report made various recommendations, the key one being that if paramedics were going to practice competently, education needed to move to an all BSc (Hons) only model. The regulatory body later accepted this recommendation and the minimum entry level for paramedic registration was subsequently raised to BSc (Hons) effective from 2021.

The result of the current educational situation is that the paramedic work force have a varied experience of training and education that may impact on competence in various situations. Such a situation was discussed in a UK paper looking at how paramedics make decisions (Ryan and Halliwell, 2012).

This was a mixed methods study with two phases, the first phase recruited

undergraduate paramedic students (n=30) and non-graduate paramedics (n=30). The second phase recruited undergraduate paramedic students and ambulance service managers (n=90). The authors concluded that decision making is partially dependent on the situational context but suggested that use of a hypothetical-deductive model is the clinically safest way to make decisions and is adopted by less experienced clinicians, such as new graduates. This decision making model involves the generation and testing of hypotheses until a final hypothesis can be accepted (Woodford, 2015), it requires the processing of large amounts of information and can be seen as slower than other methods such as intuitive reasoning, said to suit non-graduate or experienced paramedics (Ryan & Halliwell, 2012).

#### **2.4.7 Confidence and Competence**

The regulatory body for paramedicine, the HCPC published a research report consisting of a literature review followed by a study reviewing fitness to practise case notes (n=27) followed by focus groups (n=2) informed by the case note review (HCPC, 2015). Participating healthcare professionals deemed competence as having fluidity and requiring different things at different times (HCPC, 2015). Participants suggested that it was not something that involves technical skill in isolation but also the knowledge of why they are doing what they are doing in a given situation; therefore, to be competent, a professional must be able to adjust their actions if they do not get the desired response; this sentiment is echoed in the HCPC Standards of Proficiency (HCPC, 2014). The ability to make adjustments within a situation or action rests on a person's ability to evaluate how well they are performing, and identify problems, something suggested by Dunning and Kruger, that the incompetent are not capable due to

an inability in identifying their own incompetence (Dunning, Johnson, Ehrlinger & Kruger, 2003; Kruger & Dunning, 1999).

The importance of maintaining engagement is paramount when considering newly qualified professionals. The above HCPC document exploring competence highlights the importance of the two way process between the clinician and the organisation; those who perform well are likely to be offered the required organisational conditions to enable continued engagement (HCPC, 2015); therefore, being valued helps to maintain competence (HCPC, 2015). This assertion with the previously mentioned literature review exploring the newly qualified paramedic experience suggests therefore, that the consolidation and preceptorship provided by this process improves competence and confidence (Robinson, 2017).

An Indonesian mixed methods study explored job satisfaction and performance of paramedics (n=105) based on different management styles, the results indicated that a transactional leadership style will have a negative impact on performance and satisfaction (Risambessy, Swasto, Thoyib & Astuti, 2012). This highlights the value of clinician job satisfaction/morale in maintaining competence. Ambulance service staff consistently report the lowest satisfaction levels of all healthcare workers with concerns over stress, violence, bullying and harassment and appraisal highlighted (AACE, 2011; Lewis, 2018).

UK paramedics along with the other professions allied to health, regulated by the HCPC enjoy a large degree of autonomy, perhaps paramedics more than most due to the often remote nature of their work (CoP, 2015; CoP, 2019; Lovegrove & Davis, 2013); it is suggested that this autonomy may well have a positive impact on their engagement and therefore competence (HCPC,

2015). The view of registered professionals within this same HCPC publication was that competence can only be demonstrated if an individual practises with autonomy, or demonstrate the insight to highlight weakness in one's own practice (HCPC, 2015). In a similar vein, and supporting this view, professionals registered with the HCPC are expected to show this insight and report on any concerns they may have about a registrant (HCPC, 2014; HCPC, 2018c).

There is further suggestion that working practices of professionals may have an impact on performance and therefore the maintenance of competency; this was explored by a piece of qualitative research in the South West of the UK where two focus groups consisting of paramedics (n=11) identified shift work and specific aspects of the paramedic role, such as sleep deprivation as impacting on performance and therefore competence (Kirby, Moreland & Pollard, 2016). A significant aspect of the role is the lone working, common place in ambulance services. Working in isolation may allow complacency to creep into practice, as a result of a lack of team and specialist support (HCPC, 2015). Both these points invite discussion about whether unsafe practice would be able to develop and furthermore, go unrecognised.

In a UK qualitative pilot study, newly qualified paramedics (n=4) were asked about their perceived concerns in relation to practising in an environment where they are the 'accountable clinician'. Although small in scale, this study concluded that newly qualified paramedics are knowledgeable but lack confidence and experience, causing them to seek extra support from others (Thompson, 2015). A scoping review exploring international literature (n=11) relating to transition into practice of paramedic students found that the evidence regarding experience was lacking; however, it did highlight that this is a period

of significant stress (Kennedy, Kenny & O'Meara, 2015), this finding perhaps corroborates the pilot study by Thompson, 2015.

The HCPC research report suggests the consideration of competence within five discourses (HCPC, 2015);

- Knowledge discourse – Ability to recall facts and knowledge; assessed using multiple choice tests and memorisation, suggestion that this leads to book-smart professionals.
- Performance discourse – Ability to perform or behave in a prescribed way in certain situations; measured using OSCEs or other in practice observations. This can focus on what clinicians do more than what they know. This could possibly lead to mindless practices rather than thoughtful, well-reasoned care.
- Psychometric discourse – Ability to attain a standard/expectation in a statistically defensible manner.
- Reflection discourse – reflection and self-assessment within the right environment can produce a competent practitioner. Critics of this discourse suggest that overemphasis on reflection may cause technical incompetence to go unrecognised.
- Production discourse – The search for organisational efficiency. Issues with this discourse centre around patient centred care against the meeting of targets

In recent times the main discourses have produced a variety of systems that aim to hold healthcare professionals accountable for a minimum set of standards. The relative advantages and disadvantages of different discourses should prompt us to consider a collectivist discourse based on the following;

- Achievement of competence through realistic situations/scenarios, not contrived academic experiences
- Competence covers a broad group of people
- Competence constantly evolves and includes interconnected behaviours

The above points, in addition to the acceptance that constructs of competence exist in several other contexts such as emotional, psychological and cultural, link intuitively with the definitions of skills offered earlier in this chapter and the complexity of the paramedic role, also mentioned previously in this chapter.

## **2.5 Summary**

This chapter sought to establish what literature existed in relation to three broad themes; 'Paramedic Skill-set', 'Incident/skill frequency' and 'Confidence/competence', through a scoping review. Evidence and documentation from the last fifteen years, from countries around the world was included. This broad approach to review was driven by a desire to ensure that all relevant documents were included.

The identification of literature during this process helped to identify various points of interest in relation to this study. The question of what constitutes a clinical skill is contentious with various different viewpoints; however, there is recognition that that they are unlikely singular, isolated actions and more likely, a combination of physical and cognitive actions. Discussion in the literature highlights elements such as communication, physical actions, clinical reasoning and cognitive processes.

Consideration of these factors invites additional discussion about how such skills are learnt, highlighting constructivism as the most likely model where learners can utilise experience and reflection to develop their competence. It



explored the '4-stage' approach commonly used globally, despite limited evidence, within clinical professions and suggests that this allows learners to move from conscious incompetence to unconscious competence, albeit following extensive, deliberate practise. This may be over simplistic, so the inclusion of deliberate practice and learning/experience curves were explored in answer to the achievement of 'expertise' and maintenance of competence. This requires focussed practise with agreed learning outcomes and feedback in order to achieve competence initially, before developing further to eventually become an expert.

The literature around incident frequency highlights that there are many incident types only experienced rarely, causing concern for potential competence issues when considering experience curves and skill degradation (Pusic *et al.*, 2012). To date the emphasis has often been on identifying infrequent complex skills such as resuscitation. It is also important to identify the frequency of other skills as this could affect education and training. This will be the focus of phase one (chapter four). Competence and confidence were also addressed within this literature review; specifically, the difference between them and factors that might influence them such as being newly qualified in the role and educational background. Understanding an individual's competence, confidence and the interaction between these two factors will allow us to plan training. For example, when confidence does not reflect actual competence then there is a potential lack of insight and people may not voluntarily address competence issues. Phase two (chapter five) will investigate in a cohort of paramedics their perceived competence and confidence on an array of frequent and infrequent skills that are defined as being complex and not complex. The next chapter will describe the methodology and approaches used in phases one and two.

In conclusion, the literature from the scoping review shows that what constitutes a clinical skill can be a difficult question with consideration of 'soft' and 'hard' elements and the added complexity of combining the two. Learning of these skills takes place in a variety of ways but deliberate practise and placement experience are key (Ericsson, Krampe & Tesch-Romer, 1993; Ericsson, 2004; Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012). In relation to skill frequency, skill set and competence, the literature identifies that many paramedic skills are used infrequently (AACE, 2011; Bradley, 2005; Edwards, 2014) but at the same time the skill-set is broad, and growing (CoP, 2018a; Lovegrove & Davis, 2013). As already mentioned, evidence around competence highlights the importance of regular exposure/practise (Ericsson, 2008; Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012).

## **Chapter Three: Study Design and Methodology**

### **3.0 Introduction**

The philosophical approach to a study is vital to ensuring that it investigates what was intended, in a way that is congruent with the study design, thus ensuring the overall validity and reliability (Bowling, 2014; Creswell & Plano-Clark, 2017). In this chapter, the methodology of this study is explored through discussion of philosophical approaches. The evidence obtained from review of the literature is used to justify and explain decisions about the research design. A detailed explanation of how both phases of this study were carried out are presented in detail along with rationale and justification.

### **3.1 Aims and Objectives**

This study identified incidents attended and skills commonly used within UK paramedic practice. It looked to observe performance as well as exploring clinicians' impressions of their own ability and the inter-relationship between actual and perceived performance.

#### *Aims*

The aims of the study was to:

- Develop a map of incidents attended and skills commonly used in one UK ambulance service
- Assess the performance of clinicians across different types of skills
- Explore clinicians' perceptions of their competence and confidence in relation to their objectively assessed performance.

## *Objectives*

The above aims were addressed through the following objectives:

1. Identify infrequently practised skills/procedures within a large UK Ambulance Service Trust (chapter four)
2. Ascertain whether factors such as geographical location or previous experience are associated with skills practiced by paramedics (chapter four)
3. To compare competence, and perception of competence, in paramedics using a defined set of skills (chapter five)
4. To examine factors associated with competence and perception of competence (chapter five & six)
5. Identify organisational issues that are created by the growing skill set for paramedics (chapter six & seven)

## **3.2 Research Design**

In order to address the research aims, the study was conducted in two phases:

Phase one, a retrospective review of ambulance service clinical records, sought to establish frequency of incidents attended and skills practiced by UK paramedics, in both rural and urban areas over a one year period. This phase also looked at factors such as location and time of year in order to identify variances (objectives one and two).

Phase two examined actual and perceived competence in clinical skills across a range of frequency and complexity. This was achieved through participation in a simulated clinical scenario featuring a frequent and infrequent patient

presentation, and completion of a number of measures (objectives three to five). Participants also completed pre/post scenario questionnaires in order to elicit demographic information as well as their self-reported confidence/competence scores and factors they felt impacted on this.

### **3.3 Philosophy**

Philosophical consideration is the cornerstone of quality research, without it rigor will be lacking (Creswell, 2014; Creswell & Plano-Clark, 2017; Gray, 2013; Howell, 2012), which may give rise to specific issues of validity and reliability. Further, it has been asserted that justifying the methodology and methods chosen for research exposes the reality brought to our work and therefore our own theoretical perspectives (Crotty, 1998).

A framework exists in which to view this (Crotty, 1998), enabling the researcher to work through four steps of development in order to ensure construct validity, the measurement of what was intended (Creswell & Plano-Clark, 2017).

Crotty's framework begins by establishing the epistemological stance; Creswell and Plano Clark have adapted Crotty's framework and introduce the concept of a 'worldview' (Creswell & Plano-Clark, 2017); this is a broader term, encompassing a set of philosophical assumptions that will guide research approaches (Guba & Lincoln, 2005). Specifically these philosophical assumptions are epistemology, ontology, axiology, methodology and rhetoric.

A theoretical lens must be identified in order to make sense of this 'world view'. There should be a connection between the theoretical stance and 'world view' as it is this connection that will inform the methodology and methods used for a study (Crotty, 1998).

### **3.3.1 Epistemology and Ontology**

Ontology is the study of 'existence' (Marsh & Furlong, 2002), epistemology follows on logically from this, concerning itself with how we learn what we know, the theory of knowledge. Two opposing ontological backgrounds are 'being' and 'becoming'. 'Being' derives from the concept of a permanent unchanging reality, focussed on facts whereas 'becoming' derives from a changing and emerging world which focuses on people (Gray, 2013). Epistemological stances traditionally took one of two approaches; objectivism or constructivism. More recently the rise of mixed methods research has brought a third epistemological stance to the fore, that of pragmatism (Johnson & Onwuegbuzie, 2004).

### **3.3.2 Objectivism**

Objectivism suggests a world where knowledge already exists, waiting to be discovered, independent of consciousness. The positivist theoretical lens aligns to an objectivist epistemology. It is a scientific approach seeking answers through observation, believing that reality consists of what is available to the senses; thus it can be seen, smelt, heard or touched for example, it is tangible and free from bias (Gray, 2013). The researcher remains distant from the subject and seeks impartiality (Creswell & Plano-Clark, 2017). A deductive approach is likely to be used to test existing theory and hypotheses and the language used around it is very formal/scientific.

Positivism however, has been criticised with assertions that it is not possible to establish facts with absolute certainty and objectivity; challenging the notion that the observer and the observed are independent (Crotty, 1998; Howell,

2012). Karl Popper developed a more realistic position of post-positivism. This view is more flexible in its approach, accepting that the researcher and 'researched' are not entirely independent (Gray, 2013).

Karl Popper also developed the principle of falsification (Popper, 1963), whereby rather than the existence of immutable scientific laws, if one case existed that refuted a given law, provided this was reported properly, it was refuted (Howell, 2012). Therefore, in Popper's words, scientific law must remain "tentative forever" (Crotty, 1998; Popper, 1963). This principle demands that scientific theory/observation is documented thoroughly, thus laying it open to refutation.

### **3.3.3 Constructivism**

Constructivism holds an alternative view that knowledge comes into existence through our interaction with the world and is constructed (Creswell, 2014; Creswell & Plano-Clark, 2017; Crotty, 1998; Howell, 2012). Constructivism is an alternative approach to the rigid stance of objectivism/positivism or semi-rigid stance offered by post positivism. It views the world and our understanding of it as socially, politically and psychologically constructed by social groups; embracing subjectivity as a route to deeper understanding (Feilzer, 2010). In terms of actual application, it seeks to be closer to the subject being researched; it accepts biases as existing and discusses them openly. This approach tends to use an inductive approach in order to build theory and hypotheses. The rhetoric in this approach is far less formal than that of the language used by positivists/postpositivists.

### **3.3.4 Pragmatism**

Pragmatism follows a more practical approach that may be a combination of the above and involves holding the viewpoint of any position necessary (Creswell, 2014; Creswell & Plano-Clark, 2017).

Pragmatism lends itself to use by researchers who do not feel comfortable taking a solely objectivist or constructivist approach; ultimately giving greater flexibility in terms of study design and execution. It is often considered the best fit in relation to mixed methods research (Cooper, Porter & Endacott, 2011), as a result of its ability to mix traditional philosophical stances that have long been argued exclusive (Feilzer, 2010; Johnson & Onwuegbuzie, 2004). Mixing these philosophies and therefore methods used, it is argued that research is better informed (Johnson & Onwuegbuzie, 2004; Johnstone, 2004). Pragmatism is, as the name suggests, a flexible and adaptable 'world view', originally developed to present a logical viewpoint (Peirce, 1984). It seeks to clarify the significance of findings and establish consequences (Cherryholmes, 1992). Pragmatism is therefore less concerned with what has gone before and more focussed on future direction (Dewey, 1980), thus enabling real life changes to be made based on tangible findings.

### **3.3.5 Philosophical Approaches to Research**

There are research approaches that align themselves well with each of these varying philosophies (discussed above). The objectivist researchers have adopted quantitative methods, under the notion that there is a singular reality with absolute truth waiting to be discovered. These are normally deductive, seeking to test a theory.



In contrast constructivist researchers have adopted qualitative methods with a subjective approach, accepting that multiple realities exist. Qualitative research uses induction to 'work up' a theory/hypothesis (Creswell, 2014; Creswell & Plano-Clark, 2017; Feilzer, 2010; Johnson & Onwuegbuzie, 2004). Although sometimes considered so, the use of inductive and deductive methods does not have to be exclusive. Using induction to build a theory/hypothesis before deductively testing it is a logical sequence and actually the two approaches can complement each other (Creswell, 2014; Creswell & Plano-Clark, 2017; Gray, 2013).

The pragmatic approach is pluralistic and opposes the positivist, singular reality (Cherryholmes, 1992). It is often, associated with mixed methodology studies, with a primary focus on the research question and whether it has been answered, rather than the methods used to answer it (Creswell, 2014; Creswell & Plano-Clark, 2017; Feilzer, 2010; Gray, 2013). Pragmatists are said to employ diverse approaches 'that work', these approaches may include both subjective and objective knowledge; both is valued equally and offers greater insight to research and a better understanding of the situation/subject being investigated (Creswell, 2014; Creswell & Plano-Clark, 2017). Further exploration of this approach highlights its suitability for research into emergency care specifically (Cooper, Porter & Endacott, 2011).

This study took a pragmatist approach, to try and address the research question that did not fit one singular reality, but at the same time did recognise the complexity of individuals practicing in a challenging environment with complex skills.

### **3.4 Methodology**

The aims and objectives for this study sought to establish the work undertaken by UK paramedics as well as whether they have accurate views of their own clinical performance, in relation to practice of specific clinical skills. The research question therefore was, 'What work do UK paramedics undertake and do they accurately perceive their own performance?' A secondary question to this was 'What factors affect the confidence and competence of UK paramedics.' This situation is complex and involves two dimensions; firstly, clinical ability of paramedics and secondly, perception of individual ability. Philosophically, the singular, positivist approach fits with the quantitative measurement of skills against a standard. This same positivist approach would not work in exploring thoughts and feelings around personal clinical performance; traditionally, this element would take a more constructivist approach, accepting of multiple realities and therefore involve qualitative methods. This dictates that in order to answer this question, an approach must be taken that is accepting of singular and multiple realities avoiding what is described as a false dichotomy between quantitative and qualitative (Feilzer, 2010).

It is suggested that research where one data source would be insufficient, as above, is well suited to mixed methods (Creswell, 2014; Creswell & Plano-Clark, 2017). The research question is traditionally a central element to all studies; however, mixed methods are particularly focussed on the research question in hand, rather than the methodology. Mixed methods therefore can avoid discussion regarding quantitative and qualitative approaches, instead focussing whether the researcher has established what they want to know (Feilzer, 2010). This means it is imperative, that when considering the use of

mixed methods, a judgement is made as to whether the question suits the mixed methods design employed (Johnson & Onwuegbuzie, 2004).

The theoretical lens to view this requires flexibility, pragmatism is likely the best fit for this, where the researcher is free from the forced choice between positivism and constructivism; accepting both singular and multiple realities, taking the approach of 'what works' (Cooper, Porter & Endacott, 2011; Creswell, 2014; Creswell & Plano-Clark, 2017; Feilzer, 2010; Johnstone, 2004).

To further exert this standpoint, pragmatism generally leads to mixed methodology and the two are considered to complement each other (Cooper, Porter & Endacott, 2011; Creswell, 2014; Creswell & Plano-Clark, 2017; Feilzer, 2010; Johnstone, 2004). In addition, further advocacy comes from Teddlie & Tashakkori, who suggest that pragmatism and mixed methodology are a common and sound combination (Teddlie & Tashakkori, 2003).

Pragmatism allows different methods to be used in the same study, putting the research question at the heart of what is being researched, making it more important than the method or methodology. It advocates a practical and applied approach to research that should itself guide the methodology (Creswell & Plano-Clark, 2017). Further weight is added to the choices discussed here by Cooper et al, who assert that provided adequate attention is given to the study design; mixed methods research is effective within emergency care (Cooper, Porter & Endacott, 2011). One of the stated benefits of mixed methods research being that the combination of approaches yields results greater than the sum of its parts (Moffatt, White, Mackintosh & Howel, 2006), with mixed methods research seen as the third major research approach alongside qualitative and quantitative (Johnson, Onwuegbuzie & Turner, 2007).

Despite this rise in popularity and a generalised acceptance of the use of mixed methods approaches to research (Cooper, Porter & Endacott, 2011; Creswell, 2014; Johnstone, 2004), it is not without its critics; the issue of conflicting data often being highlighted (Moffatt *et al.*, 2006). The stance of some researchers has been that integrating fundamentally conflicting philosophies is simply not possible (Johnstone, 2004).

The use of mixed methods for phase two of this study invites consideration of the structure and design from a practical viewpoint.

#### **3.4.1 Mixed Methods Design**

In order to effectively address what this study sets to, sound consideration must be given to the design. Creswell and Plano Clark state that although mixed methods can be effective in the right situations they can also be challenging due to the use of both quantitative and qualitative methods (Creswell, 2014; Creswell & Plano-Clark, 2017). There are specific elements that should be considered in relation to study design such as weighting/priority, timing and mixing of the two data strands (quantitative and qualitative); these are explored below (Cooper, Porter & Endacott, 2011).

#### **3.4.2 Weighting/Priority**

Weighting of the study is vitally important and will be driven by the research question/focus; it involves setting the balance between quantitative and qualitative approaches. In general consideration, there are three options for priority; equal, quantitative priority or qualitative priority (Creswell & Plano-Clark, 2017).

Phase two of this study was largely quantitative due to a focus on collection and analysis of numerical scores during the evaluated clinical scenario and confidence/competence scores.

### **3.4.3 Timing**

Timing relates to the collection of quantitative/qualitative data strands, it can be concurrent, sequential or multiphase combination. A concurrent design involves collection of both quantitative and qualitative data during the same phase. Alternatively data could be collected sequentially, meaning during different phases. Finally, multiphase combination involves multiple phases of data collection that include sequential and/or concurrent design.

A concurrent approach was taken in phase two of this study, participants attended once where all data were collected.

### **3.4.4 Mixing**

During the study design a decision must be made in relation to the mixing of these strands. This mixing can be carried out at various stages; study design, data collection, data analysis or data interpretation (Creswell & Plano-Clark, 2017). This picture perhaps over-simplifies the prospect, it is suggested that researchers sometimes struggle with truly integrating the data strands and often default to 'presentation of findings by juxtaposition' (Feilzer, 2010). This discussion is advanced by further suggestion that often the two strands are asking a different question due to their differing philosophy, they say that that the two should be seen as complimenting each other rather than simply bolting one to another (Moffatt *et al.*, 2006).

Combination of some data from phase two took place at the analysis stage.

Further mixing took part during the data interpretation where free written answers regarding confidence and competence were considered in relation to the actual and self-reported scores.

### **3.4.5 Mixed Methods Models**

Various considerations to the development of mixed methods approaches have been discussed and explored above. Within the broad context of mixed methods studies there are several models and designs that can be considered and then adopted.

The means of mixing the quantitative and qualitative data has already been broadly discussed in relation to phase two, this process is termed integration (Creswell, 2014); there are various ways of integrating quantitative and qualitative data and for this phase an 'embedded' approach will be taken. The rationale for is that this allows different questions within the same study to be answered; this differs from the convergent design which only addresses one question (Creswell & Plano-Clark, 2017). In this study the research questions considered both actual and perceived performance, as well as factors that could affect this. The questionnaire element, exploring perception of performance and confidence is linked to, but separate from the actual performance element; therefore leading to the use of an embedded design (Cooper, Porter & Endacott, 2011; Creswell, 2014; Creswell & Plano-Clark, 2017). Its use in the context of this research allows focus on the research question and uses 'what works' in order to answer it (Feilzer, 2010). In relation to mixing methods, the end result of the research and answering the research question is, at the end of the day, the most important aspect (Johnson & Onwuegbuzie, 2004). Correct

use of this approach should make for a disproportionate increase in strengths of the study but should not increase any weaknesses (Brewer & Hunter, 1989). This embedded design will be quantitatively weighted. Data collection for the two strands will be concurrently collected with the mixing carried out at the point of study design.

### **3.5 Phase One Methods**

Phase one of this study was a retrospective review of patient clinical records that sought to identify information in relation to types of incident attended by paramedics as well as skills used; specifically, it needed to identify complex and simple skills performed on a frequent and infrequent basis, in preparation for phase two. This phase also sought to look at factors such as location and time of year in order to identify variances.

#### **3.5.1 Instruments**

The goal of this phase was to enable collection of data that would inform the researchers about the skills that would be selected for use in phase two; specifically, the information being sought was in relation to the type of incidents attended and skills used. It took the form of a quantitative study involving retrospective review of anonymised patient clinical records (PCRs).

The required data was obtained from PCRs completed by clinical staff within a local ambulance service trust.

A purpose designed data collection tool was created for Phase one, this was largely informed by the design of the clinical record used by the Trust, which is split into a 'tick box' type section and a space for free text (see Appendix 3).

The data collection tool can be seen in appendix 2.

### *Time spent with patients*

'Time with patient' is defined within this study as the time spent with the patient from arrival on scene to arrival at hospital. This seems to be the most logical definition as it covers the actual period that the paramedic is with the patient.

### **3.5.2 Sites and Sample**

The sample was split equally between a rural and urban station, the decision about the areas used was informed by the ambulance service trust and some of the limitations that surrounded their PCR collection processes. Within each of the selected geographical areas an equal number of clinical records were randomly selected from each month.

### **3.5.3 Sample**

A specific sampling calculation was used to ensure the study was adequately powered. The sample size decided upon using this was 600 PCRs; this number was designed to identify incidents and skills occurring in 5% or more of ambulance service activity, with a precision of 2.5% (Naing, Winn & Rusli, 2006).

A request was made to the local ambulance service trust to gain access to the PCRs following ethical approval for the study. A specific twelve-month period of May 2013 to April 2014, was agreed on with the local ambulance trust research and audit department. This was the most contemporary, complete sample that could be achieved. Call signs were identified for the urban and rural stations chosen, this meant incidents allocated to a specific station's resources could be identified and isolated. A chronological list of all incident



numbers for each location over the specified one-year period was then created.

Incident numbers for each of the relevant months/locations were then put into a spreadsheet and using the specific Microsoft Excel function were randomised. This generated a random, non-chronological list of incidents numbers for each of the months, for each of the locations (rural and urban).

### *Eligibility*

The list of incident numbers was then systemically worked through (top to bottom) and the PCRs connected to each incident number searched for and reviewed for suitability. They were excluded at this point for any of the following reasons;

- The clinician who completed it was not a paramedic
- The patient had not been conveyed to hospital
- There was any question over the vehicle call-sign and therefore the origin of the attending vehicle

If an incident was rejected, a reason was recorded and the author moved to the next number on the list, this process was repeated until twenty-five suitable records had been selected for each month at each ambulance station, thus providing the overall total of 600 records within the year.

Following this selection, a software package was used to electronically redact any non-essential, sensitive/patient data. The records were then printed in preparation for data collection.

### **3.5.4 Data Analysis**

Following initial data collection, information was then transferred to the IBM Statistical Package for Social Sciences (SPSS), version 24, in preparation for analysis.

The author had minimal control over missing data during collection; this is largely a result of the study design, retrospective review. The main source of missing data was recording of time, where it was omitted in 2.33% (n=14) of records reviewed. In addition 0.5% (n=3) of records reviewed were missing age data. The author felt that this fell into the 'forgot to answer' category (Gray, 2013) and had a very limited impact on the overall dataset. Given the retrospective nature of the data collection it is reasonable to surmise that the omission of data was not deliberate. The time pressure often related to prehospital unscheduled care perhaps suggests it is reasonable to presume that it was simply down to omission. Anecdotally the author suspects that the trend exists with incident times as during transport to hospital, whilst in the ambulance saloon with the patient, there is no access to the mobile data terminal to retrieve times prior to arrival at hospital; at this point, transfer of the patient from the ambulance becomes the main priority.

The data were then analysed using SPSS. Simple descriptive analysis was initially used to review the data and begin building a picture. Following this, inferential statistics (cross tabulation with chi squared) were used to analyse relationships between various datasets. This approach allowed the author to look at incident/skill frequency in the context of month or geographical location for example. This highlighted areas of paramedic practice commonly, and less commonly encountered, as well as variances in geographical location and time of year. The statistical significance level for this phase was set at  $P = <0.05$ ,

therefore significant results had a less than 5% probability they occurred by chance

During analysis some continuous variables were grouped, for example, 'age' and 'time with patient'. Grouping of variables was generally determined by creating an approximate equal split within original data collection groups. This collapsed the data, making it more manageable (Gray, 2013). Age was looked at using a couple of different split groups; revised groupings were created by adaption from the Office of National Statistics (ONS), 'Harmonised Standard 2' for age grouping.

### **3.6 Phase Two Methods**

Phase two, aimed to establish clinicians' competency/confidence in relation to four of the clinical skills identified in Phase one; specifically, this was a combination of simple, complex, frequent and infrequent. During this phase clinicians' perceptions of their own performance were also explored. The clinical performance of paramedics, as previously stated, lends itself to quantitative methods. The exploration of clinicians' perception of their own performance is ideally achieved through qualitative investigation. Due to the nature of this phase a mixed methods design was used. Caution is advised with the use of mixed methods approaches, the suggestion being that researchers can view it as a 'solve all' approach and they must have the knowledge required to use the right study design (Almalki, 2016). However, as already stated, other sources identify it as a pragmatic approach to complex situations where qualitative or quantitative data alone would not answer the research question (Cooper, Porter & Endacott, 2011; Creswell & Plano-Clark, 2017).

### 3.6.1 Mixed Methods Model

The specific design used for this phase is an embedded model. This approach, as suggested by the name, embeds either qualitative or quantitative elements into the others, with the purpose of aiding interpretation of findings (Cooper, Porter & Endacott, 2011). Figure 3.1 is adapted from the work of Creswell and Plano Clark (Creswell & Plano-Clark, 2017) and shows the embedded design used for phase two of this study, it gives priority to the quantitative approach with an embedded qualitative element collected concurrently.



Figure 3.1, Embedded Mixed Methods Design. Adapted from Creswell and Plano-Clark, 2017

### 3.6.2 Weighting/Priority

The evaluation/scoring of a clinical scenario as well as collection of numerical scores in relation to competence and confidence suggests that the quantitative element of this study should be given priority as it is the main approach. The smaller, qualitative element, exploring reasons behind the scores, was therefore embedded into the larger quantitative one.

### **3.6.3 Timing**

Timing of data collection was concurrent, both quantitative and qualitative data collection occurred within the same process. Qualitative and quantitative data was collected from pre/post clinical scenario questionnaires and the clinical scenario evaluation recorded only quantitative data.

### **3.6.4 Mixing**

The two data strands were mixed initially at the study design stage through the use of the questionnaire, this is given as an example of embedding (Creswell, 2014). Following this, the quantitative and qualitative data was mixed during the analysis stage, as advocated by Creswell and Plano-Clark (Creswell & Plano-Clark, 2017).

### **3.6.5 Instruments**

As detailed above, phase two was an embedded mixed methods study with unequal weighting, priority given to quantitative data. It included simultaneous quantitative/qualitative data collection. The rationale for this approach was that it would enhance the understanding of information from the study by using two methods; in addition, it would facilitate triangulation of the results (Almalki, 2016; Creswell & Plano-Clark, 2017).

The specific method for data collection during phase two was a combination of questionnaire and an observed clinical scenario, where the research participant 'plays' the part of a paramedic. Participants were requested to complete the questionnaire prior to, and following participation in the scenario. This involved

specifically designed data collection tools for evaluation of the scenario as well as pre and post scenario questionnaires (see appendices 4 to 6).

### *Questionnaires*

These questionnaires were developed through a review and revision process with input from supervisors and clinical colleagues, thus facilitating a process of improvement. This process culminated in the data collection trial with third year paramedic students, prior to actual data collection. The contents were also informed by the phase one results in allowing identification of clinical skills according to their complexity and frequency.

Both questionnaires (appendices 4 & 6) were self-administered, structured tools; they included a mixture of open and closed questions in order to elicit specific, targeted information as well as the opinions/feelings of the participant (Bowling, 2014). Generally the open (so called 'probing') questions followed closed questions in order to seek clarification and explanation (Bowling, 2014; Gray, 2013).

Throughout the questionnaires a Likert style, ordinal numeric scale was used, this ranged from zero to ten (Bowling, 2014), based on the work of Preston & Colman showing that rating scales with up to ten or eleven categories provide optimal reliability and validity, particularly for the measurement of complex constructs, and are preferred by respondents (Preston & Colman, 2000). The scale started at zero as theoretically it is possible to have no competence/confidence.

### *Scenario*

The scenario and its progression was also informed by the data from phase one; linked to this, the evaluation rubric (appendix 5), similarly to the questionnaires, was developed using a review and revision approach. Feedback was sought from lecturing staff familiar with the design/use of rubrics and clinical colleagues. These instruments then underwent the same trial as the questionnaires with paramedic students, prior to 'live' data collection. This process allowed constant revision until the point data collection began, thus ensuring content validity (Bowling, 2014). The decision to use a rubric reflected the ability of this type of tool to measure technical, clinical performance (Mertler, 2001); in addition, the use of rubrics is said to facilitate a reliable, valid process (Jonsson & Svingby, 2007). The use of a clinical scenario rather than isolated unconnected skills enables a better understanding of the participants' performance in context (Carraccio *et al.*, 2008). The performance standard set for the rubrics was drawn from both local and national guidance for each of the selected skills.

### *Testing*

Prior to data collection and as briefly mentioned above, the phase two process was tested three times on separate third year paramedic students who were about to graduate, these students were not later used as participants and their information was not included in the data analysed for this study. All aspects of phase two data collection were tested; consenting of the participant, pre/post scenario questionnaires, clinical scenario and the participant debrief. This allowed development of all instruments as well as refining of timings and the design of scenario progression.

### *Sample*

A paper analysing perceived and actual competence found an overall moderate correlation of 0.29 (+/- 0.11) between self-evaluations and actual performances (Zell & Krizan, 2014), highlighting the discrepancy between these measures. An initial calculation established that 90 participants would be required to sufficiently power phase two of this study ( $\alpha=0.05$ , power=0.80). Previous work with doctors and medical students (n=41 studies) has used an average of 101 participants (Blanch-Hartigan, 2011). The target of 90 participants was set; however during data collection, it became apparent that this was unrealistic so exploratory analysis established that data collected from approximately 60 participants already showed correlation similar to that in the existing literature. Following a power calculation the author was able to settle on a revised sample size of 69, in a study not seeking to generalise findings.

Purposive sampling was used for this phase, this type of non-probability sampling allowed the author to recruit participants from a population based on what the study aimed to establish as opposed to convenience sampling which would have been recruitment based on accident, such as location (Etikan, Musa & Alkassim, 2016).

### *Recruitment*

Participants were drawn from the local ambulance service trust. All staff employed by the trust, in the role of ambulance paramedic (not in a specialist role), in either a 'bank' or permanent capacity were eligible. The Trust covers multiple counties in the UK. Initial recruitment began in Devon and Cornwall as this was where data collection for phase one took place; paramedic numbers



within the Trust at the time of design were not obtainable, however, the 2017/18 annual report recorded 1645 paramedics working within the Trust (SWASfT, 2018), requiring a 5% response rate. A low response rate triggered recruitment from other areas within the trust (Somerset, Dorset and Avon).

Paramedics within the local trust area were invited to take part in phase two of the study using a variety of methods. These included use of email, advertisement in weekly ambulance trust publications, utilisation of networks such as university alumni, programme practice educators and conversation with staff groups at education events for example.

This recruitment plan was informed by consultation with paramedics who work for the Trust used in the study. Their opinion was sought, in relation to how the required response rate was best achieved.

Four key points were taken from this process;

- Participants were approached/invited on a personal level; leaflet dropping and bulletin articles will have limited impact with already stretched operational staff
- The process of data collection was carried out locally to make it as accessible and easy to participate as possible
- Use was made of the programme alumni and mentors, with which good working relationships have already been fostered
- Inclusion of a learning/CPD angle was felt to be attractive, such as a separate clinical area that they can attend following any assessment to build on the experience

### **3.6.6 Data Collection**

Participants underwent an evaluated clinical scenario which focussed on four skills identified in the first phase of this study based on their frequency and complexity. Clinical performances were evaluated through the use of an analytic scoring rubric, as previously discussed.

The clinical scenario was designed to be run with an actor and an assessor, approximately half way through the scenario the patient (actor) would become unresponsive and pulseless, at this point, the patient would then be a manikin. The layout for the scenario was standardised, as was the equipment, which was exactly the same for every participant (excluding consumables such as intravenous cannula and examination gloves). During the planning process, detailed guidance for both the actor and assessor role was developed to ensure consistency (Bowling, 2014), see appendix 6. For the actor, this included clinical/patient details that could be shared with the participant during their assessment and history taking. For the assessor, this included information that could be shared with the participant as well as timings for various stages of the scenario and details about progression, such as the point at which the patient would progress from an alert to unresponsive state. The researcher consented and briefed the participants prior to facilitating completion of questionnaires and the scenario, where they also evaluated the participants' performance. Prior to and following the evaluated clinical scenario, participants were asked to complete a questionnaire to ascertain information such as demographic data confidence and self-reported competence. The post observation questionnaire re-visited confidence and self-reported competence following the observed scenario; in addition, it offered an opportunity for participants to provide a short, free-text explanation of what they felt affected their competence/confidence.

The process that participants go through during data collection is shown in figure 3.2.



Figure 3.2, Phase Two Data Collection Process

### 3.6.7 Skills Segregation for Phase Two

#### *Skill Difficulty*

Skills from phase one were categorised as simple or complex, in preparation for use in phase two.

It is recognised, as previously mentioned in chapter one, that some paramedics hold specialist roles in areas such as critical care so a distinction needed to be made between the skill set of these clinicians and the skill-set of a 'standard' paramedic practising in the traditional non-specialist role. This was achieved by cross-matching the local ambulance trusts skills passports with the Phase one data collection tool, itself derived from the Trust patient clinical record.

### *Skill Difficulty*

Appendix 15 shows the skills recorded during phase one in the context of local ambulance trust roles; from initial employment grades of staff, such as ambulance care assistants practicing in a non-emergency role through to the 'standard' paramedic grade. Clinicians can perform any of the skills within their grade skill-set in addition to any of those skills within the grade skill-set/s below; therefore, all of the skills in Appendix 15 are available to 'standard' paramedics practicing in the local trust area.

Before this information could be used to establish skills for observation in phase two, amalgamation was required, from the four categories of difficulty into two categories, simple and complex, this is shown in appendix 16. The logical step was to combine the first two clinical grades, Ambulance Care Assistants (ACA) and Emergency Care Assistant (ECA) and the third and fourth grades, advanced technician and paramedic; this created two distinct skill groups.

### *General Observations*

The process of categorising skills did highlight an issue in relation to the recording of general observations. A set of observations includes a wide range of skills/assessments. In recognition of this, and to simplify the situation, the author defined a basic set of 'general' observations as respiratory rate, heart rate, blood pressure/capillary refill, oxygen saturation, Glasgow coma scale and pupillary response. This grouping was designed to represent the cornerstone elements of assessment as described in the UK Ambulance Services Clinical Practice Guidelines (Fisher, Brown & Cooke, 2013). In addition, these aspects of assessment were also clearly denoted on the patient clinical record which made accurate data collection more likely.

Table 3.1, Skills Difficulty

Skill Level	Ambulance Care Assistant	ECA / Student Paramedic	Advanced Technician	Paramedic
Difficulty (based on skill level)	Simple		Complex	
General Observation	Ventilatory Rate	Blood Pressure	Glasgow Coma Scale	
	Pulse	Oxygen Saturation	Pupillary Response	
	Partial Set – if any of the above findings are missing. Simple if GCS/pupillary response not recorded)		Complete Set - must include all of the above findings, in which case it will be a complex skill also due to GCS/pupillary response inclusion	

The process of recording a GCS and pupillary response was required to make a set of observations complete, according to the local ambulance trust skills passports, these are technician/paramedic skills; therefore, a complete set of observations was deemed complex in terms of difficulty and a set of observations without GCS or pupillary response would be simple. Table 3.1 shows the skills required, in this study, for a partial/complete set of observations.

### *Skill Frequency*

One of the primary objectives for phase one was to establish the frequency of technical skills used by paramedics in the UK. This information was then used

to decide what skills were frequently and infrequently practiced in the context of difficulty level.

The concept of frequency can be difficult to define; it can be thought of in terms of 'lag', time between incident/practice of a procedure. Alternatively, it can be thought of in terms of incident/procedure in relation to the number of other incidents that occur in between. In context, these two variations work as follows;

Lag - relates to how often an incident might be experienced or a procedure carried out in terms of time; for example, how many times in a year will a paramedic manage a patient in cardiac arrest or how many times a year they will perform IV cannulation.

Rate - relates to frequency in terms of the numbers of incidents or procedures between each other. For example, how many incidents occur between each cardiac arrest or IV cannulation.

These two concepts are subtly different to each other; how busy a station/area/paramedic is will potentially lessen or increase the effect of frequency in terms of number of incidents attended before a condition/procedure repeats.

For the purposes of this study a frequent skill was deemed one that was recorded on more than twenty-five percent of incidents.

#### *Difficulty and Frequency Combined*

The final establishment of skills for observation was carried out through creation and review of table 3.2 below; it combines skill frequency (established in phase one) with skill difficulty.

Table 3.2, Skills difficulty and Frequency

Difficulty	Skill	Frequency (%)	Frequency (n =)
<b>1 - Simple</b>	Additional Observations	56.2	337
	PEFR	0.3	2
	FAST	44	267
	3 lead ECG	1.5	9
	12 lead ECG	37	222
	Airway – Manual Manoeuvres	0	0
	Airway - OP/NP	0.6	4
	Combat Application Tourniquet	0	0
	Drug Administration - Inhaled	31.8	191
	Immobilisation - Spinal	5.3	32
	Immobilisation - Other	1.1	7
<b>2 - Complex</b>	General Observations	43.7	262
	ABCD2	0	0
	Airway - iGel	0.3	2
	Airway - ETI	0	0
	Needle Cricothyroidotomy	0	0
	IV cannulation	26.5	159
	IO Access	0.3	2
	Drug Administration – All Other	57.8	347

Analysis of skills in relation to their difficulty and frequency allowed the identification of four types of technical skill for observation;

- simple, frequent
- simple, infrequent
- complex, frequent
- complex, infrequent

Phase one, in addition to establishing what skills paramedics use, sought to establish what incidents were attended. This exploration showed that in the review of six hundred records, only 0.5% (n=3) showed a provisional diagnosis code indicating cardiac arrest. In contrast 4.6% (n=29) showed a provisional diagnosis code of M15 – acute coronary syndrome; although at first this still seems an uncommon code, in the context of the one-hundred and forty-five different codes this was actually the third most common type of incident attended overall.

The above information regarding frequency of skill usage, incident attendance and skill difficulty led the author to consider the use of a cardiac chest pain scenario that develops into cardiac arrest. This would not only potentially cover the desired skill difficulty/frequency aspects, but also would encompass a frequent/infrequent incident aspect too. The skills selected for observation were provisionally;

- simple, frequent skill – Oxygen Administration (Drug Admin – Inhaled)
- simple, infrequent skill – Basic Airway Maintenance (Manual Manoeuvres & Basic Adjuncts)
- complex, frequent skill – IV cannulation
- complex, infrequent skill – SGA/ETI  
(Intermediate/advanced Airway Maintenance)



## Standards

The observation of skills listed above for phase two involved evaluation. The author opted to do this through the use of observed scenarios, evaluated using a rubric approach as previously discussed.

The practice standard set for this observational evaluation was taken from various profession specific guidelines/documents. These can be seen below in table 3.3, mapped against the relevant skills being observed (Fisher, Brown & Cooke, 2013; Gregory & Mursell, 2010; O'driscoll, Howard & Davison, 2008).

**Table 3.3, Skills for Scenario and Standard Required**

Resuscitation Council ALS guidelines	X	X	X	X
Resuscitation Council BLS guidelines	X		X	
SWAST ETCO2 Monitoring guideline				
SWAST Cardiac Arrest guideline	X	X	X	X
SWAST Airway Management guideline			X	X
SWAST ACS guideline	X	X		
Plymouth University Airway OSCE			X	X
Plymouth University IV Cannulation OSCE		X		
JRCALC UK Ambulance Services Guidelines	X	X	X	X
HCPC, Standards of Proficiency	X	X	X	X
Manual of Clinical Paramedic Procedures, Gregory & Mursell	X	X	X	X
BTS O2 guidelines	X			
O2 Administration				
IV Cannulation				
Airway – Manual				
Airway – Inter / Advanced				

### **3.6.8 Data Analysis**

Data analysis for phase two was carried out through a combination of quantitative and qualitative approaches. Analysis of data was carried out independently for each separate strand (qualitative & quantitative). Quantitative data was analysed using SPSS to allow simple descriptive analysis. Following processing of both of these data sets, the two were integrated to establish a deeper understanding as well as cross-referencing the data (Creswell & Plano-Clark, 2017).

Initial analysis involved descriptive statistics, with exploration of demographic data. The relationship between self-appraisal and actual performance scores was made using Spearman's rank order to ascertain correlation. Differences between pre and post scenario self-appraisal scores were assessed using Wilcoxon signed rank test and Friedman's test, a Bonferroni calculation was also conducted to prevent a type one error. The statistical significance level for this phase was set at  $P = <0.05$ , therefore significant results had a less than 5% probability they occurred by chance

All qualitative data from the post scenario questionnaire was entered onto a spreadsheet and following initial familiarisation, it was subjected to a process of 'open' coding to establish early identification and labelling of categories (Gray, 2013). These codes were then colour coded by the author for easy identification and analysis (Goodwin, Mays & Pope, 2006). Following this, refinement of these codes into broader categories culminated in the development of nine, more focussed emerging themes (Bazeley, 2013), as can be seen in chapter five. Throughout this process an academic colleague reviewed the same data to see if themes had been missed or incorrectly identified.

The process above allowed for the developed themes to be viewed in the context of the quantitative data, it is suggested that this approach is well suited for analysis of small amounts of qualitative data from a mixed methods study (Goodwin, Mays & Pope, 2006). A sample of the qualitative data was reviewed in order to ensure rigor, and identify themes not already highlighted. Caution is advised however, in order to prevent pursuing too many new ideas when the data has already been analysed (Goodwin, Mays & Pope, 2006; Riley, 1990). The same authors do highlight the idea that this can potentially, negatively impact on qualitative research, where the researchers see may see the world from a philosophically different viewpoint, therefore interpret data differently (Goodwin, Mays & Pope, 2006); however, the qualitative data from this study is very small in quantity and was collected in a very structured way, limiting the possibility of multiple interpretation.

### **3.7 Rigour**

Consideration of rigor for mixed methods studies in general can be challenging (Wisdom, Cavaleri, Onwuegbuzie & Green, 2012), it is usually a concept associated with quantitative designs (Bowling, 2014). As the methods used for this study were predominantly quantitative, issues of rigour were addressed with reference to validity, reliability and minimising bias.

#### **3.7.1 Validity**

##### *Phase one*

Internal validity relates to whether a study measures what it sets out to measure (Bowling, 2014), this broad definition can be viewed as three separate considerations when designing a study; content, construct and criterion (Heale

& Twycross, 2015). Phase one sets out to identify incident types attended and skills used, as well as various other data such as location, see appendix 2. This information should all be recorded on patient clinical records, from which data will be collected. The clinical records have specific areas set out for the recording of this information as well as tick boxes for specific skills (see appendix 3). A study looking at retrospective data collection from clinical records did highlight that subjectivity can confuse information between the patient and the medical record at the time of consultation, which then impacts the quality of data collected (Jansen, van Aalst-Cohen, Hutten, Büller, Kastelein & Prins, 2005); however, paramedics in the UK are regulated by the HCPC who set standards of proficiency that required accurate history taking and documentation (HCPC, 2014). As such, it should be presumed that content validity is present in phase one.

Secondly, is the consideration of homogeneity for the phase one design; again, the use of a 'uniform' patient clinical record to collect data means that this was the same process for all records with the same information collected by clinicians and the information in the same places. This standardisation of data collection is important, not only to ensure the reproducibility of research data but also for the internal validity (Jansen *et al.*, 2005). A customised data collection tool was designed for this phase, thus ensuring that the same data was sought for each record reviewed. The final measure, 'criterion' involves measurement of the same data with a different instrument, this was not possible in phase one of this study.

External validity relates to the extent to which a study can be generalised across a wider context (Bowling, 2014). The professional body for paramedicine as well as two reports based on the strategic direction of UK

ambulance services agree a similar stance on the contemporary workload of ambulance services (AACE, 2011; Bradley, 2005; CoP, 2019); as a result, it would be logical to suggest that findings from phase one would be generalisable and therefore demonstrate external validity in looking at rural and urban incident frequencies.

### *Phase two*

The question of validity within mixed methods research is the subject of debate (Creswell & Plano-Clark, 2017), with some authors questioning the need for its consideration due to historical connections with quantitative approaches (Maxell & Mittapalli, 2010). This said, validity, although maybe more widely considered for quantitative approaches in the past (Cypress, 2017), is important in the use of qualitative designs too (Creswell & Plano-Clark, 2017).

A practical and simple definition of validity within this methodology is the defined quality of a study throughout each stage of the process (i.e. methodology, design, data collection, analysis, conclusion) (Onwuegbuzie & Johnson, 2006). In this context, validity was ensured through regular supervisory meetings with regular review of the study design to improve and develop it; in addition, the primary supervisor for the author is experienced in this area of research, so was able to bring considerable experience to the discussions.

Traditional consideration of validity often leads to 'construct' validity, does the 'instrument' measure what it purports to measure (Bowling, 2014). This consideration logically leads to the clinical scenario used and the pre/post questionnaire. Throughout the design both the questionnaires and scenario rubric were reviewed not only by the study supervisory team, but also other paramedic colleagues; this process ensured that they had both 'face' and

'content' validity; therefore, were relevant and clear, whilst also being balanced and clear (Bowling, 2014; Gray, 2013).

### **3.7.2 Reliability**

#### *Phase one*

Reliability of a quantitative study refers broadly to the consistency of measurement (Heale & Twycross, 2015). Validity and reliability are related to each other but can be discreet, it is therefore important to consider both within study design (Bowling, 2014).

The previous section looking at phase one validity has offered a rationale as to how this was addressed and justified during design. Consideration of reliability looks at some similar concepts; homogeneity, stability and equivalence; however, these concepts do not fit so well with this retrospective clinical record review design.

Homogeneity seeks to ensure that the results measure one construct, this concept did not fit well with this study design, retrospective review of clinical records; however the use of an NHS Trust clinical record and specifically designed data collection tool should have ensured that the same thing was being measured from all forms.

Demonstration of equivalence requires good inter-rater reliability in measurement/collection of data (Heale & Twycross, 2015), for phase one of this study, the data was collected by one person, making any question of inter-rater reliability irrelevant in this context; however, as an additional measure, to ensure data collection was completed accurately, an academic, independent of the study reviewed the data collection of 8.3% (n=50) of records to verify the accuracy and highlight any potential bias (Jansen *et al.*, 2005).

In addition frequency analysis was employed by the chief investigator to identify any errors (Gray, 2013).

### *Phase two*

Reliability is a concept more often associated with quantitative methods although does exist in qualitative realms too, with thematic analysis for example (Creswell & Plano-Clark, 2017). It refers to the consistency of an instrument, ensuring reliability begins with consideration of validity during study and instrument design (Bowling, 2014). The considerations of reliability mentioned above (homogeneity, stability, equivalence) have more relevance for phase two of this study. Reliability has been accounted for through a carefully designed data collection tools (see Appendices 4 to 6), developed through an iterative process and tested prior to their use for final data collection. This process allowed refinement of timings and the scenario set-up as well as adjustment of the questionnaire content and the rubric scoring, thus improving reliability as well as validity (Bowling, 2014; Gray, 2013; Norland, 1990). In addition, there was only one person involved in evaluating the clinical scenarios, removing concerns over inter-rater reliability.

A second and important consideration of reliability is that of inter-rater reliability, the extent that different raters agree (Bowling, 2014; Gray, 2013). This was not an issue within this design as it was planned that only the chief investigator would evaluate the clinical scenario.

### **3.7.3 Minimising Bias**

Bias can be considered a systematic distortion of statistical results due to a factor not allowed for in the design of the study, it can affect the validity and

reliability of a study; however, it should be acknowledged that bias exists to some extent in all studies (Sica, 2006; Smith & Noble, 2014).

### *Phase one*

The retrospective design of this phase relies upon accurate interpretation of records, potentially putting the study at risk of measurement bias (Harris & Taylor, 2003). The clinical record and data collection tool were designed to have an innate objectivity and therefore avoid bias. Specifically, this was done through selecting technical skills that required a tick box confirmation; it was felt that this would be more reliable in relation to data collection.

Further, the process of a retrospectively collecting data from clinical records brings with it some potential subjectivity in relation to information being passed from the patient, to the clinician, to the report form (Jansen *et al.*, 2005).

Similar to the above, the study design was informed by the design of the local ambulance trust patient clinical record, as was the data collection tool; the Trust may have specific reasons for including certain information and fields within its form and therefore the possibility of data collection bias exists (Noble & Smith, 2015).

### *Phase two*

A well designed study should limit the potential for bias (Smith & Noble, 2014). Both phases of this study were given significant thought and consideration; in particular, the phase two design went through an iterative process due to the complexity of its structure. Given the educational background of the author it could be argued that there was possible design bias, with the choice of this design being driven by familiarity, rather than good practice (Smith & Noble,



2014). Despite this it is asserted that as discussed at the beginning of this chapter, the methodology fits the study aim rather than the author's preferences.

The data for phase two of this study was wide ranging and due to the mixed methods design was varied in its type. As a result, it was important for correct statistical tests to be done in order to reduce the risk of analysis bias (Simundic, 2013; Smith & Noble, 2014), the details of these tests can be seen in the study results, chapter 5.

The use of a rubric (see appendix 5) to evaluate the scenario element of phase two introduced some concerns for the author over data collection bias.

Anecdotally the use of a checklist to evaluate practical tasks has been considered more reliable; however, global rating scales, more closely related to rubrics have been found to be as reliable as checklists (Cunnington, Neville & Norman, 1996).

It is recognised by the author that there is a risk of participants demonstrating social desirability bias in relation to self-reporting information on their own competence and confidence (Bowling, 2014); however, the overall design for phase two was intended to measure variances in participant's own opinions of performance against actual performance, it is therefore not considered that this potential would be damaging to the study.

### **3.8 Ethical Issues Addressed in the Design and Conduct of the Study**

Ethical approval was sought, as appropriate from the local ambulance service NHS trust, University of Plymouth Faculty Research Ethics and Integrity Committee and Health Research Authority (HRA) for both phases of this study due to its use of NHS resources (records and staff) (HRA, 2020;

University of Plymouth, 2020). The approval documents can be seen in appendices 7 to 11. Some of the more specific ethical considerations of each of the phases are acknowledged below.

#### *Phase one*

Consent from patients/clinicians was not sought for phase one, this decision was underpinned by the following rationale:

- All data items collected were recorded as part of the patient's usual care
- No identifiable data items were collected
- The anonymised PCRs were reviewed retrospectively; hence there was no opportunity to change the patient's management following review
- The PCR review did not allow the research team to make judgements about the appropriateness or quality of care provided.

#### *Phase two*

Following University, Trust and NHS ethical approval, participants were invited to take part; prior to participation they were provided with an information sheet and consent form to review (see appendices 12 & 13). These documents contained explicit information about the nature of the research and how it would be carried out. Before any anonymisation of data, participants had the right to withdraw from the study. Data collected during phase two was stored securely at all times.

Time was planned at the end of each participant's data collection session for an individual debrief. In the event that concerns of any sort were identified regarding a participant this provided an opportunity to offer tailored support and advice.

### **3.9 Summary**

This chapter explored the philosophical approach that the study would take, it highlighted the complex question being asked and justified the adoption of a pragmatist approach, rather than use of a traditional positivist or interpretivist methods. The adoption of pragmatism allows the exploration of a question without the restriction of traditional research paradigms. Its effectiveness in emergency care studies has been shown.

Mixed methods may be viewed as an easier option by some when compared to the more traditional quantitative or qualitative methods in isolation; however, the content within this chapter has offered insight into the detailed consideration that has gone into this study, such as weighting of the different methods, timing of data collection and how the different types of data was mixed.

## **CHAPTER Four: Phase One Results**

### **4.0 Introduction**

In this chapter the results of the review of incidents attended, and skills used by paramedics are presented. It will report on broad incident groups attended by paramedics in a UK ambulance service, before narrowing the focus to look at specific incident codes. Following this, the frequency of technical skills used at these incidents is reported. Both the incidents attended and skills used are explored in the context of location and time of year to examine whether these factors bear any influence. Finally, this chapter concludes with a brief discussion around the results and a summary.

These results are reviewed in more depth in the discussion chapter (chapter six), in relation to the wider picture of competence and confidence of paramedics that are practicing skills of varying complexity and frequency.

### **4.1 Overview of Phase One Data**

The sampling plan for phase one of this study was that in total, 600 clinical records spanning a year would be reviewed, these were to consist of 300 records for each location, further divided into 25 records per month.

#### *Missing data*

There were a small number of missing data items; the main area for missing data was the recording of incident related times, affecting 2.33% (n=14) of records reviewed. In addition 0.5% (n=3) of records reviewed were missing age data. The researcher had minimal control over missing data during collection; this was as a result of the design, retrospective review of paramedic clinical

records; meaning if it was not recorded on the clinical record, it could not be collected. Due to this, it is reasonable to assume that the items were not missing due to a problem with the study design itself (Bowling, 2014).

Records with missing data were excluded from the relevant data analysis, i.e. considerations of age and time spent with patient.

#### *Time with patient*

Time with patient is defined and justified in chapter three, as the time spent with the patient from arrival on scene to arrival at hospital. The two stations used with this study had very different localities in relation to their general receiving hospitals; the rural station is 25 miles from the closest receiving hospital where as the urban station is less than one mile. It is therefore realistic to expect a significant variation in these figures. A decision was made to still include this data as ambulances often travel out of their area and also because of the potential for this data to demonstrate variances in practice.

## **4.2 Incident Categories**

The logistics of analysing incident frequency are not as simple as they initially seem. The local ambulance trust uses 145 provisional diagnosis codes to identify incidents. During data collection 92 separate codes were identified on clinical records. To use this data-set was not always appropriate or informative due to its size and the infrequent nature of some of the codes; therefore, the 92 codes were re-considered under eight, broad, groups for some aspects of analysis. These revised groups were largely informed by the general groups that the provisional diagnosis codes fall into. The individual diagnosis codes

and broad groups can be seen in appendix 17. In addition there was one additional broad group ('Other') (see Table 4.1).

Table 4.1, Broad Incident Groups

<b>Full Name</b>	<b>Abbreviation</b>
Cardiac	Cardiac
Gastrointestinal	GI
Neurological	Neuro
Other	Other
Other Medical	Oth Med
Psychiatric/Mental Health	Psych/MH
Respiratory	Resp
Trauma (injury)	Trauma

Most of the categories are self-explanatory; however, 'other' and 'other medical' could be less intuitive; Table 4.2 gives an explanation of each.

Table 4.2 Other/Other Medical Broad Incident Group Details

<b>Table 4.2 Other/Other Medical Broad Incident Group Details</b>	
<b>Other</b>	<b>Other medical</b>
Obstetrics/Gynaecology	Hypo/Hyperglycaemia
Poisoning (accidental)	Syncope
Environmental	Allergic reaction
Social	Epistaxis
Other	Urinary tract infection
	Sepsis
	Medical other
	Anaphylaxis

Use of broader incident codes made the results easier to understand in some contexts; this will be highlighted within the following data analysis.

#### 4.2.1 Frequency of Broad Incident Groups

Figure 4.1 shows the frequency of broad incident categories for rural and urban areas combined.

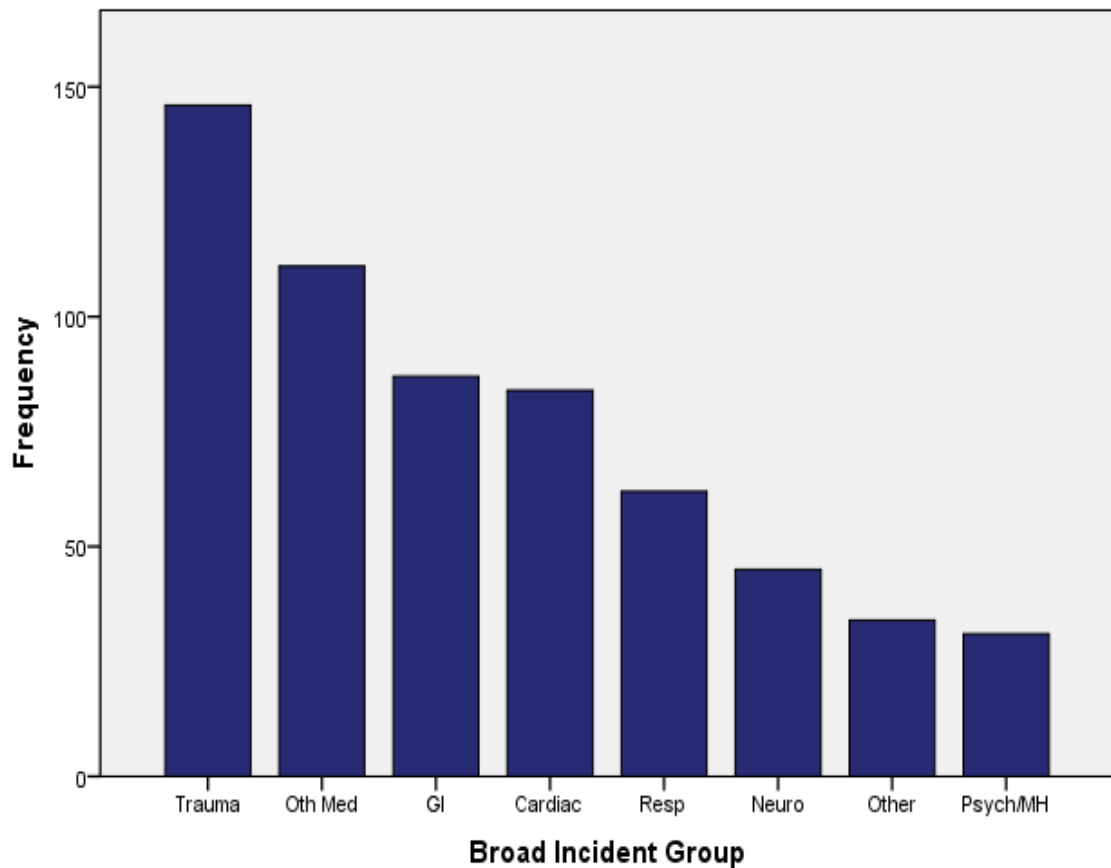


Figure 4.1, Broad Incident Group Frequency

In general, trauma is the largest category, 24.3% (n=146). This is likely as the category is very diverse; it includes minor trauma that may have required only basic assessment/treatment, to significant trauma, potentially meeting the major trauma criteria; however, out of the six hundred records reviewed, only 0.1% of records (n=1) specified the major trauma code and the same was true of the multisystem trauma code. Figure 4.2 shows the composition and frequency of the broad group of trauma codes from the most to least common.

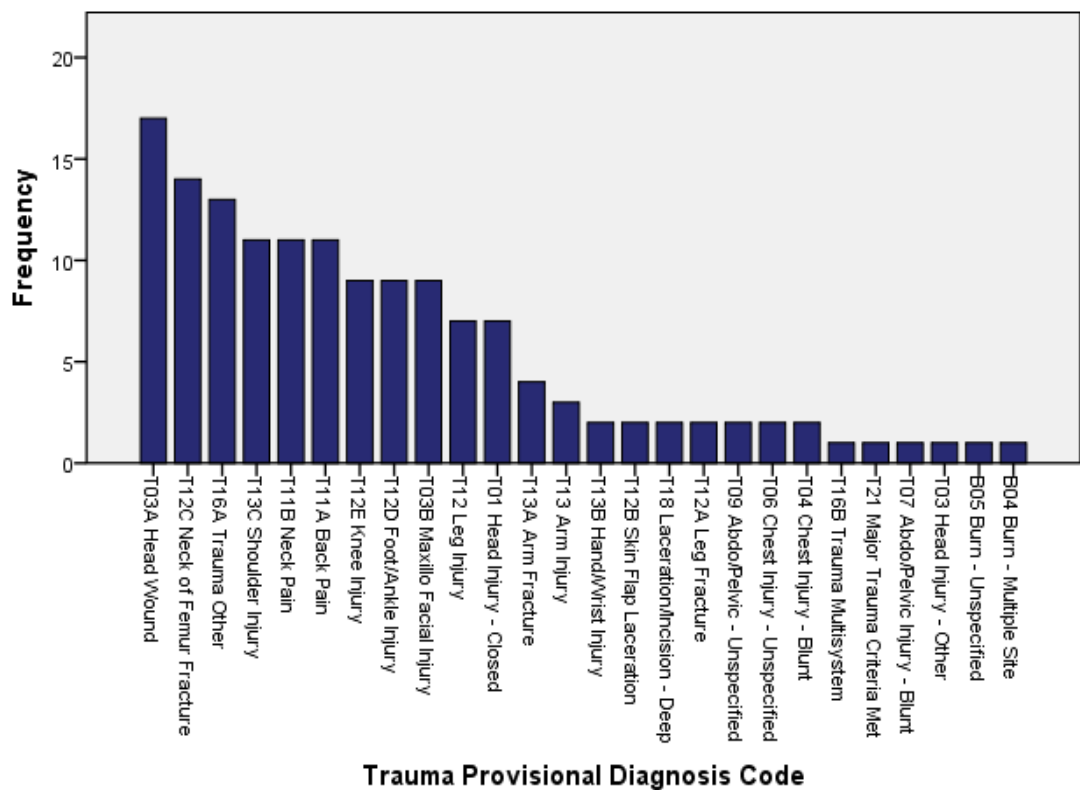


Figure 4.2, Trauma Provisional Diagnosis Code Frequency

Other Medical, is the second largest broad category and represents multiple different medical conditions such as diabetic emergencies, sepsis, epistaxis, UTIs, syncope and more. Notably within the category of the cardiac broad group, cardiac arrests were only identified at three of the incidents, less than 1% of all records reviewed.

Analysis of broad incident types in relation to the geographical area shows slight variance between urban and rural areas, this can be seen in figure 4.3.

The order of frequency for both locations is similar. The urban data mimics that of the combined picture; for the rural area cardiac and GI are reversed. These differences were not found to hold statistical significance,  $X^2 = 10.15$ ,  $p = 0.18$ .



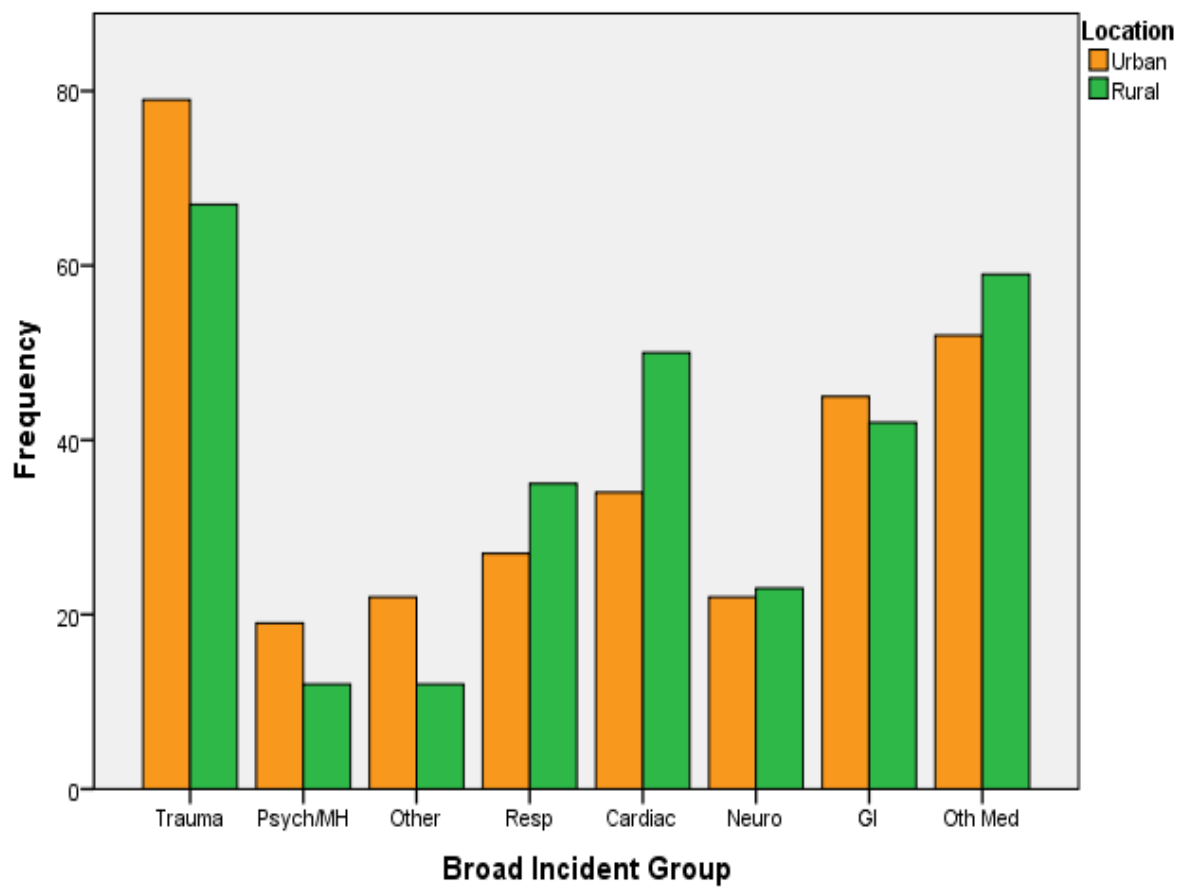


Figure 4.3, Location and Frequency of Incident Type

Similarly, as can be seen in table 4.3, when general incident frequency and season are analysed there is no significant difference,  $X^2 (21, n = 600) = 15.283, p = 0.809$ .

Table 4.3, Season and Broad Incident Type

Season	Broad Incident Type								Total
	Trauma	Psych / MH	Other	Resp	Cardiac	Neuro	GI	Oth Med	
Winter	33	7	9	15	18	8	27	33	150
Spring	35	7	10	18	21	10	19	30	150
Summer	47	9	5	13	20	12	19	25	150
Autumn	31	8	10	16	25	15	22	23	150
Total	146	31	34	62	84	45	87	111	600

Despite the lack of statistical significance when reviewing time of year and broad incident groups, the results do show a trend with an increase in trauma frequency during summer months, this is shown in figure 4.4.

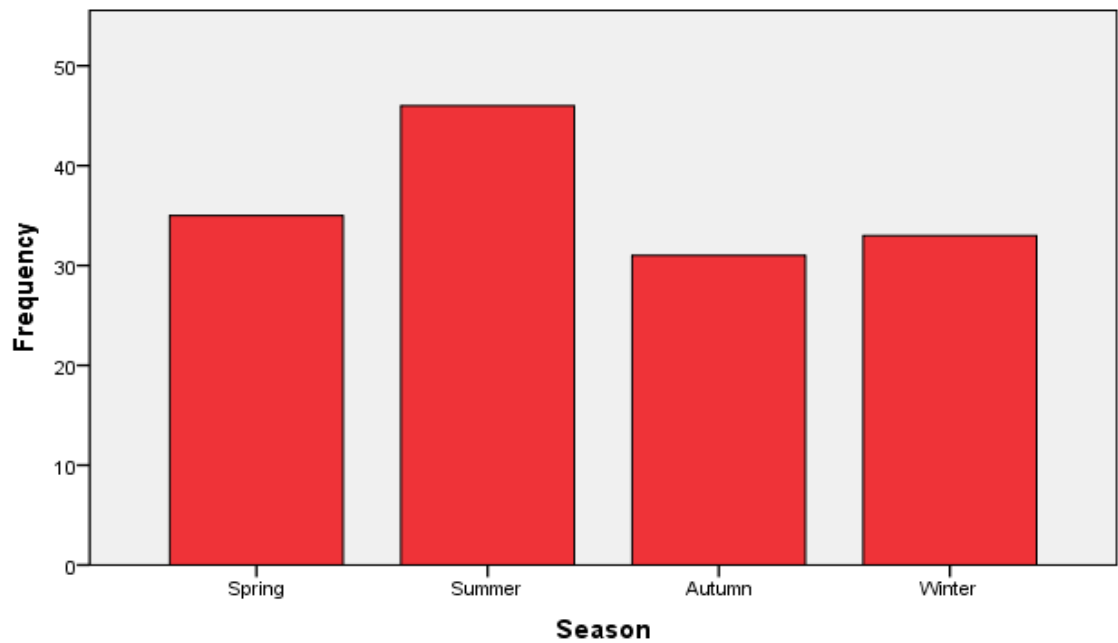


Figure 4.4, Season and Trauma Incident Frequency

#### 4.2.2 Provisional Diagnosis Coding of Incidents

Broad incident codes were divided into more specific provisional diagnosis codes (defined locally by the NHS Trust) in an effort to gain further insight. When frequency of incident is reviewed in terms of these individual provisional diagnosis codes, a different picture emerges.

Table 4.4 shows the most frequently occurring provisional diagnosis codes for all records reviewed (one being the most frequently attended). The most common three are diverse codes, this could explain their frequency.

Table 4.4, Common Provisional Diagnosis Codes

<b>Order of Frequency</b>	<b>Provisional Diagnosis Code/Condition</b>	<b>Percentage of incidents reviewed (out of 600 records)</b>
<b>1</b>	M21 – Acute abdomen	8.3% (n=50)
<b>2</b>	M58 – Medical Other	7.3% (n=44)
<b>3</b>	M15 – Acute coronary syndrome	4.8% (n=29)
<b>4</b>	M05 – Chest infection	4.2% (n=25)
<b>5</b>	M62 - Sepsis	3% (n=18)

The provisional diagnosis codes within this table account for 27.6% (n=166) of the incidents reviewed. In total seventy-five different provisional diagnosis codes were recorded.

When provisional diagnosis codes are explored in the context of geographical location there is some variance albeit not statistically significant. Table 4.5 shows the top five occurring provisional diagnosis codes for each geographical location (one being the most frequently attended).

Table 4.5, Common Provisional Diagnosis Codes and Location

Order of Frequency	Urban Station	Rural Station
1	M58 – Medical Other (n=27)	M21 – Acute abdomen (n=32)
2	M21 – Acute abdomen (n=18)	M15 – Acute coronary syndrome (n=18)
3	M62 – Sepsis (n=12)	M58 – Medical Other (n=17)
4	M15 – Acute coronary syndrome (n=11) M24 – Gastrointestinal other (n=11) T03A – Head wound (n=11)	M05 – Chest infection (n=15)
5	D02 – Overdose (non opiate) (n=10) M05 – Chest infection (n=10)	M57 – Syncope (faint) (n=12)

When the five most common provisional diagnosis codes are reviewed in the context of geographical location there are some differences in codes/frequency; although such variation was not present with the broad codes, it was not significant.

A greater number of provisional diagnosis codes make up the top five most frequent incidents within the urban area when compared to the rural setting as they were identical numbers for several codes (e.g. acute coronary syndrome and head wound both had 11 occurrences). Eight codes therefore make up the

top five in urban areas compared to five in the rural setting. This perhaps suggests paramedics in urban areas attend a more varied case load; however, overall, 76 different codes were recorded in the urban setting and seventy-two in the rural area, thus dispelling this.

There were also different codes contained within each area. Notably, trauma making a re-appearance and the presence of sepsis, gastrointestinal other and overdose for the urban setting. These did not appear in the rural top five; however, syncope did appear in the rural setting but not in urban areas.

The picture of provisional diagnosis codes and location is expanded in table 4.6. The table presents all codes that appeared three or more times during the review of clinical records, ie codes that account for greater than 0.5% ( $n \geq 3$ ) of all incidents reviewed. The top five codes are highlighted in colour (blue/urban & green/rural).

Table 4.6, Common Provisional Diagnosis Codes and Location (expanded)

Provisional Diagnosis Code	Location	
	Urban	Rural
D02 – Overdose Non Opiate	10	6
M05 – Chest Infection	10	15
M09 – Respiratory Other	2	7
M12 – Chest Pain Unspecified	4	7
M15 – Acute Coronary Syndrome	11	18
M15D – Tachycardia	6	6
M16 – Stroke	7	3
M20 – Neurological Other	7	6
M21 – Acute Abdomen	18	32
M24 – Gastrointestinal Other	11	2
M57 – Syncope (faint)	5	12
M58 – Medical Other	27	17
M59 – Allergic Reaction	1	6
M61 – Urinary Tract Infection	5	9
M62 - Sepsis	12	6
T03A – Head Wound	11	6
T03B – Maxillo Facial Injuries	6	3
T11A – Back Pain	4	7
T11B – Neck Pain	4	7
T12C – Neck of Femur	7	7
T12D – Foot/Ankle Injury	6	3
T13C – Shoulder Injury	8	3
T16A – Trauma Other	5	8

If specific provisional diagnosis codes are reviewed in the context of the month, similarly to the broad groups, there is no difference of statistical significance. This is likely due to the size of the data set and the infrequent occurrence of many codes.

Interestingly, when the specific code, M05 - chest infection, was reviewed in the context of season there does appear to be a trend; it shows a peak in frequency from October to January. This can be seen in figure 4.5; this was not shown to have significance.

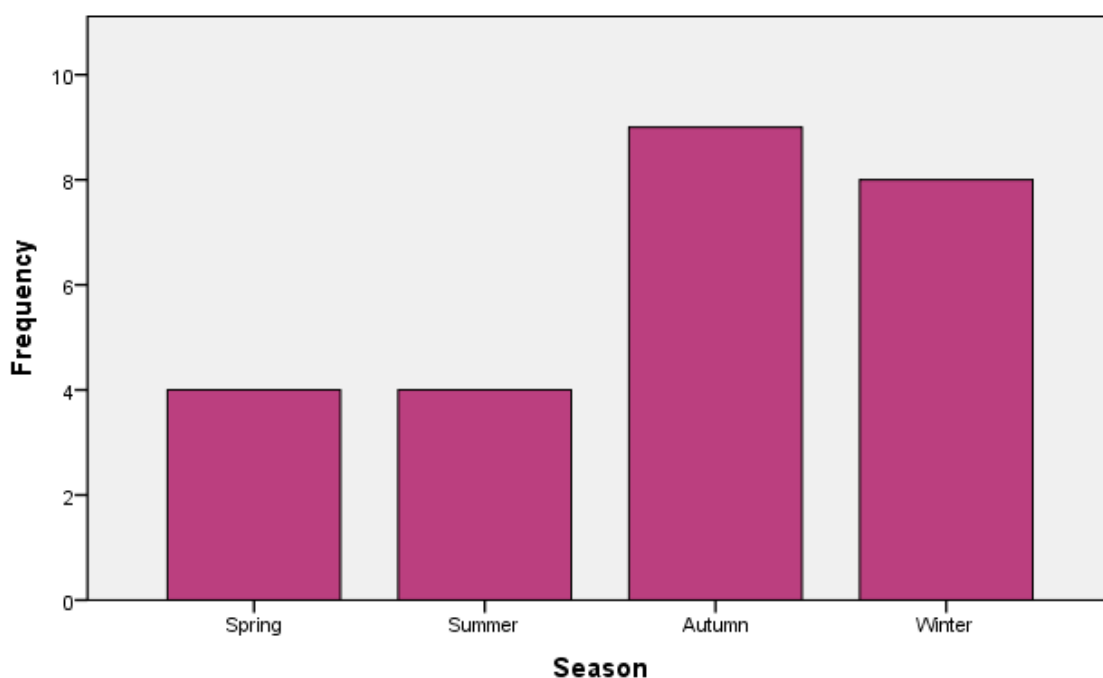


Figure 4.5, Season and Chest Infection Code (M05)

### 4.3 Age

In relation to the study aim and objectives, frequency of patient age was analysed in the context of various factors, such as location and season, this data is detailed in the following sections.



### 4.3.1 Age Grouping

During collection of data, ages were recorded in ten separate categories. During analysis it became apparent that this sometimes offered too many variables to draw informative conclusions; therefore, the initial categories were amalgamated into fewer, broader groups, as shown below in table 4.7.

Table 4.7, Age Groupings

Age grouping for data collection	Revised age grouping	Age group name
<12mnths	Birth – 17yrs	Paediatric / Adolescent
1-11yrs		
12-17yrs		
18-29yrs	18 – 39yrs	Adult
30-39yrs		
40-49yrs	40-59yrs	Middle age
50-59yrs		
60-69yrs	60-79yrs	Older adult
70-79yrs		
80-89yrs	>80yrs	Elderly
90-99yrs		
>100yrs		

The revised age ranges were designed to give an approximately equal spread for each group. This collapsed the data making it more manageable (Gray,

2009). The revised groupings were created by adaptation of the Office of National Statistics, Harmonised Standard 2 for age grouping.

### 4.3.2 Age Grouping Frequency

Figure 4.6 shows the age grouping frequency for all records reviewed. Particular points of note here are the small number of young patients encountered by paramedics; this *does* make sense given that younger patients are generally more fit and healthy.

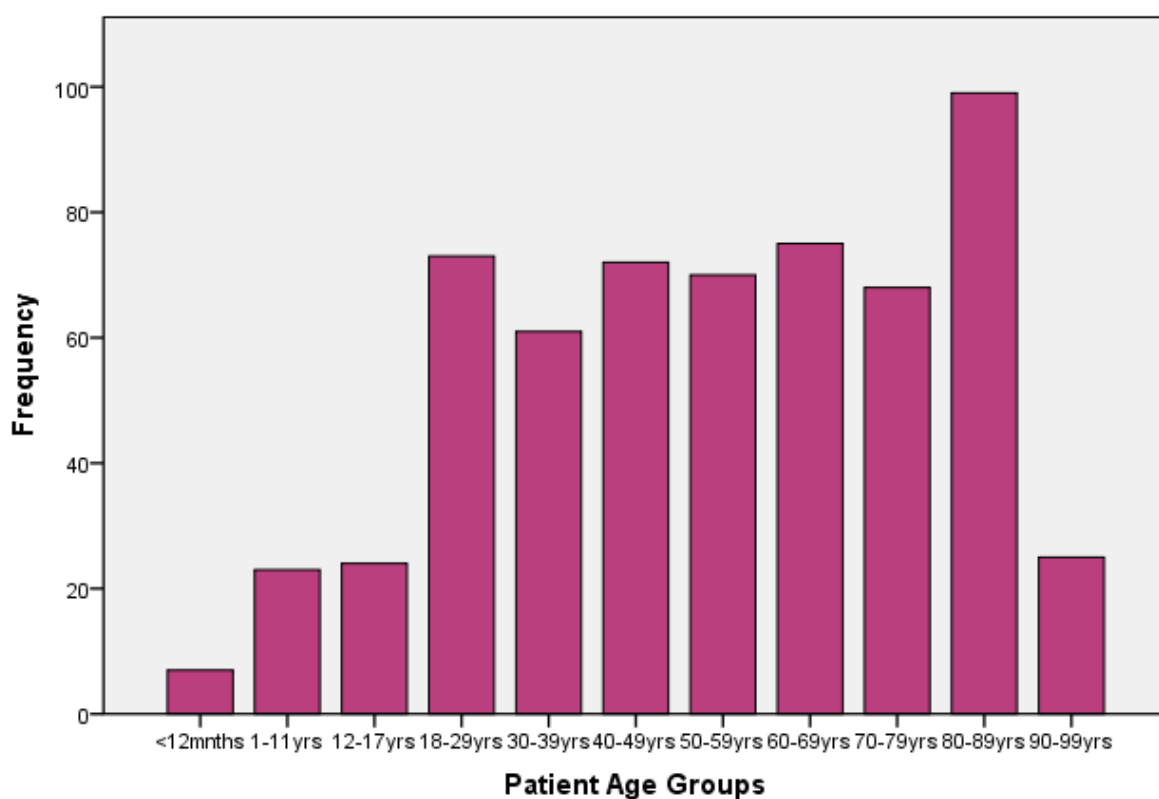
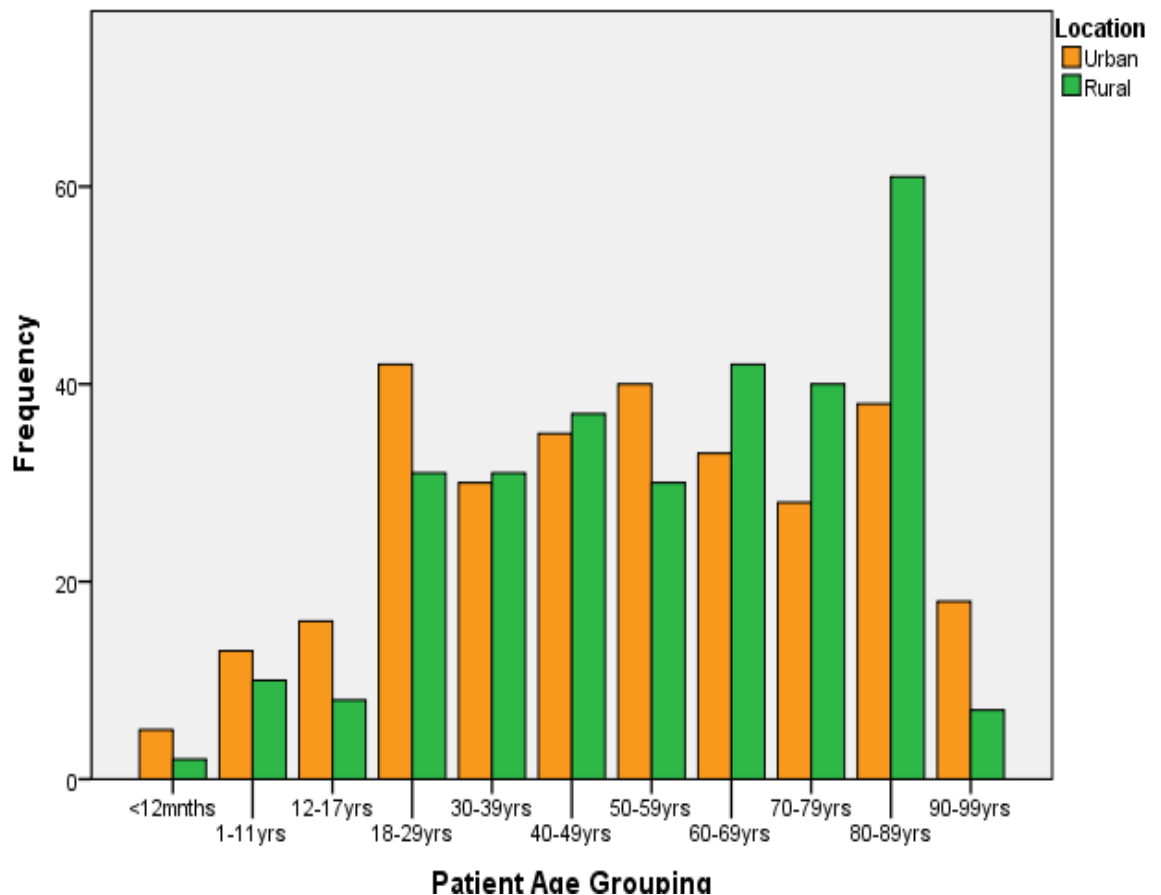


Fig 4.6 Age Grouping Frequency

### 4.3.3 Age Grouping and Location

Figure 4.7 (below) expands on figure 4.6; it demonstrates the previously mentioned broad age ranges and compares rural and urban areas. This cross

tabulation was found to hold statistical significance,  $X^2 = 623.287$ ,  $p = <0.001$ . Review shows that crews working in the urban setting will see a greater proportion of birth to 29 year olds, whereas rural paramedics will generally attend more 30 to 89 year olds.



#### 4.7, Age Grouping and Location

Figure 4.8 shows a comparison of broad age groupings and season, this analysis used the named broad groupings for age in order to make the data easier to interpret. No statistical difference was demonstrated,  $X^2 = 11.844$ ,  $p = > 0.458$ .

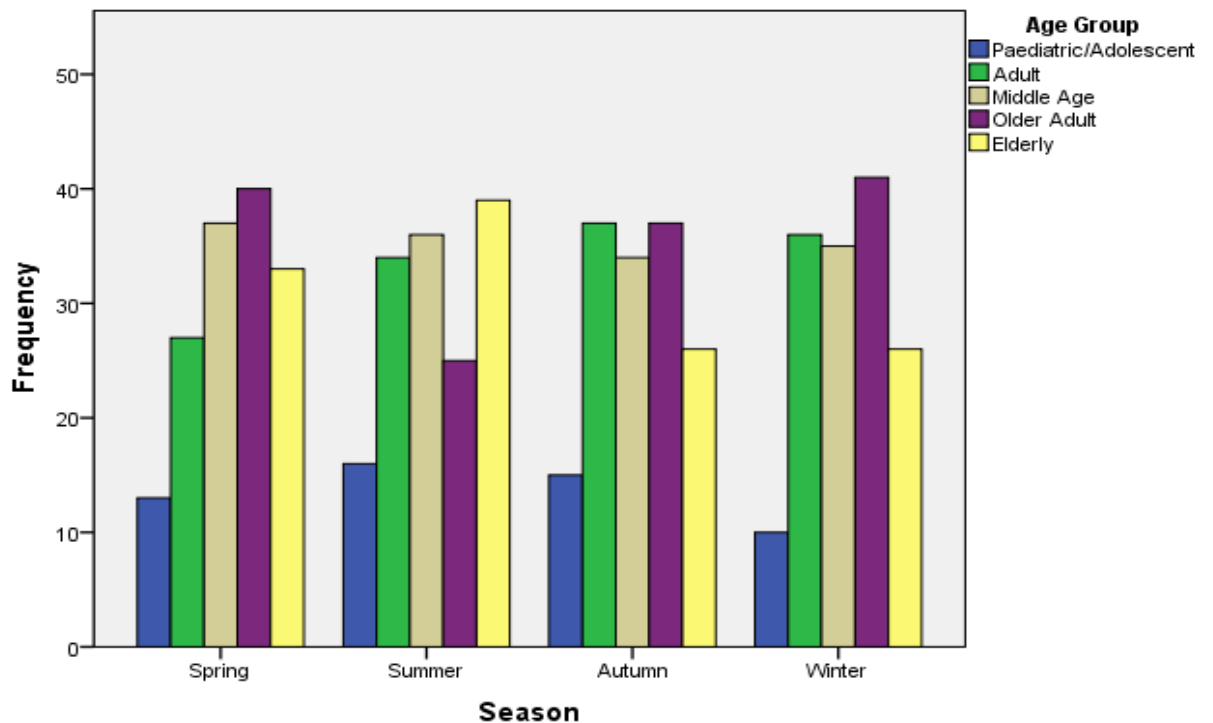


Figure 4.8, Season and Broad Patient Age Frequency

A deeper comparison of the above (age/season) that includes geographical location also shows no statistical difference,  $X^2 = 0.06$ ,  $p = 1.0$ .

#### 4.3.4 Age, Incident Theme and Location

Analysis of grouped ages, incident themes and geographical location, although not statistically significant ( $X^2 = 9.795$ ,  $p = 0.200$ ), does appear to show some interesting points worthy of highlighting. This can be seen in table 4.8; specific points of note are;

- The incidence of Psyc/MH attendance was most common in adult and middle age patients. There were very few incidences within the paediatric/adolescent and elderly groups
- There were substantial numbers of older adults that fell into the Cardiac, Respiratory and Neurological incident categories

Table 4.8, Incident Type, Location and Age Comparison

Age Group		Incident Type								
		Trauma	Psych/MH	Other	Resp	Cardiac	Neuro	GI	Other Med	Total
Paediatric/ Adolescent	Urban	15	0	2	4	1	3	5	4	34
	Rural	7	1	0	6	1	1	2	2	20
Adult	Urban	20	13	12	1	0	5	10	11	72
	Rural	17	9	7	1	3	5	12	8	62
Middle Age	Urban	17	5	7	8	13	4	13	8	75
	Rural	12	2	1	7	16	10	10	9	67
Older Adult	Urban	8	1	0	10	13	3	9	17	61
	Rural	13	0	3	11	18	5	10	22	82
Elderly	Urban	18		1	4	7	7	7	12	56
	Rural	18		1	9	12	2	8	18	68
Total	Urban	78	19	22	27	34	22	44	52	298
	Rural	67	12	12	34	50	23	42	59	299

#### 4.4 Observations/Assessments

Observation and assessment encapsulates much of paramedic activity on scene, hence a basic set of 'general' observations was defined in order to create a logical starting point for investigation.

For the purpose of the study, as explained in chapter 3, a complete set of 'general observations' was defined as;

- Respiratory rate
- Heart rate
- Blood pressure/capillary refill
- Oxygen saturation
- Glasgow coma scale
- Pupillary response

This observation 'set' represents the cornerstone elements of assessment: breathing, circulation and neurological status. In addition these aspects of assessment were also clearly denoted on the PCR, which made accurate collection more likely.

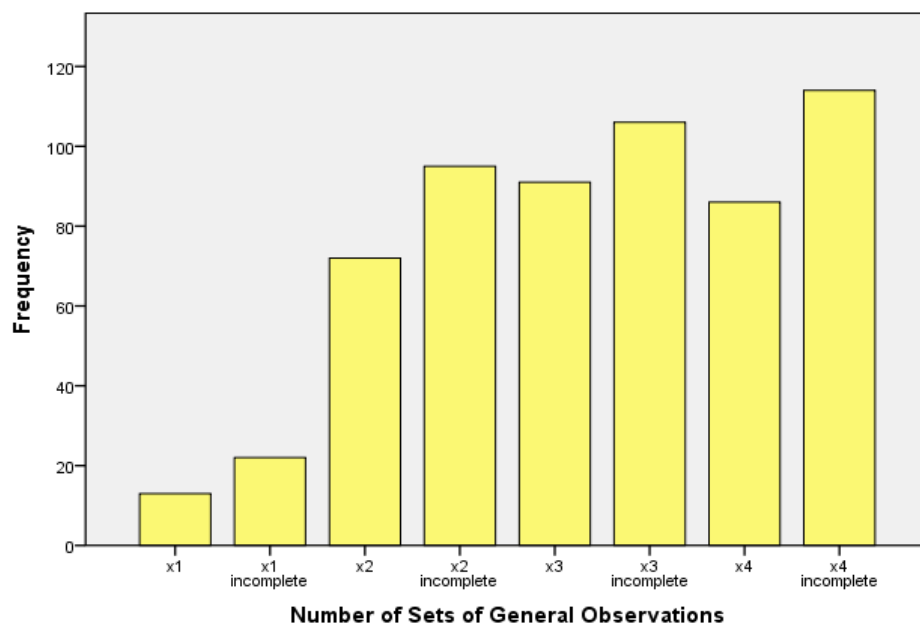


Figure 4.9, Frequency of General Observations

Figure 4.9 demonstrates that during the majority of patient contact, more than one set of general observations is recorded, sometimes this set will be complete and sometimes incomplete but the practice of recording more than one set of observations is sound and expected practice.

Encouragingly, overall, a third of patient records ( $n = 200$ ) had four sets of observations (complete or incomplete) documented. This indicates a high level of vigilance. Overall, 56% ( $n=337$ ) of records had incomplete sets of observations recorded compared to 43.7% ( $n=262$ ) with complete sets.

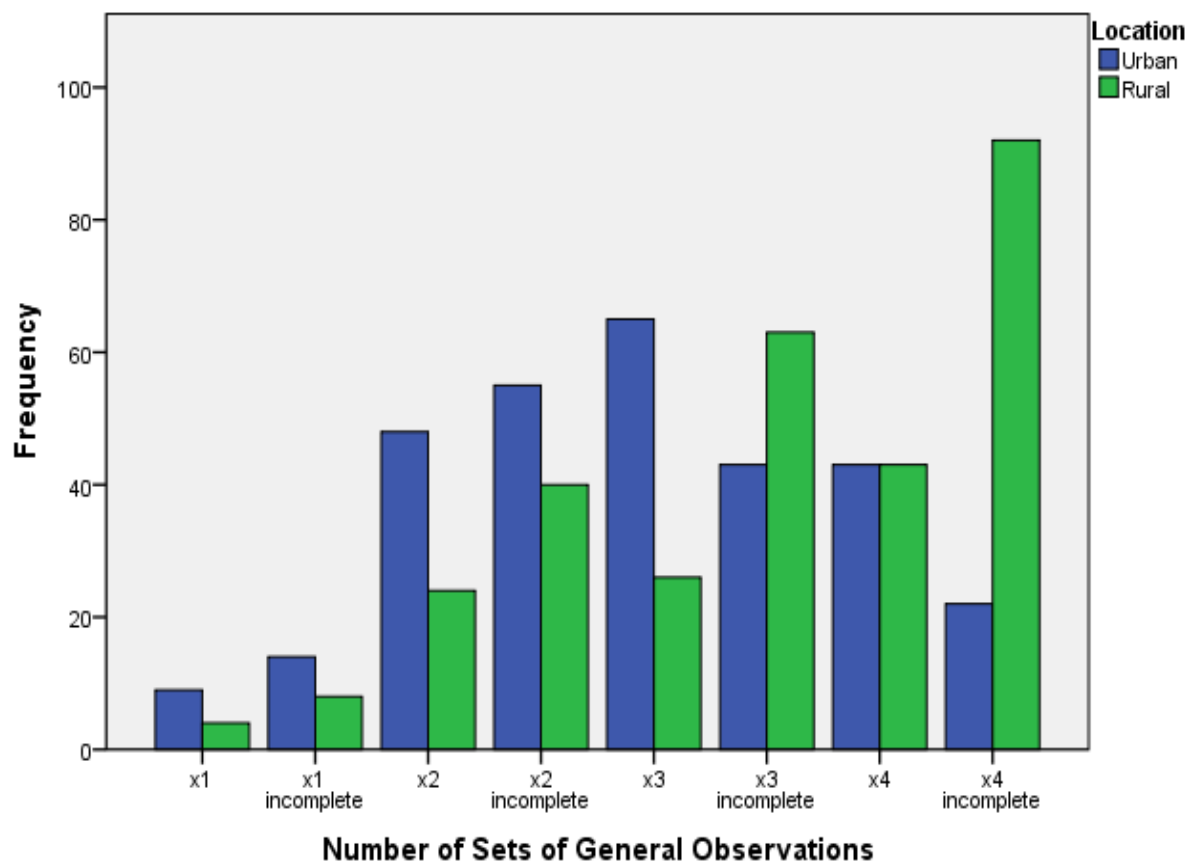


Fig 4.10, Frequency of General Observations and Location

When a more location focussed view is considered, as can be seen in figure 4.10, we see the general trend is repeated with single sets of observations (complete and incomplete) making up the smallest categories. Paramedics

working in the urban area recorded a greater number of complete sets of observations than their rural counterparts.

Conversely, paramedics working in a rural setting recorded three and four sets of general observations more often than their urban counterparts,  $X^2 = 478.65$ ,  $p = 0.000$ ; this is likely a result of having longer patient contact time.

If general observations are looked at in relation to the month of the year, there appears to be no significant difference in frequency of recording and time of year,  $X^2 = 88.41$ ,  $p = 0.17$

Analysis of observations and patient age showed a significant trend in that fewer sets of general observations are recorded for paediatric and adolescent patients. These age groups accounted for 21.14% ( $n=126$ ) of all records recorded with the middle age and older adult groups completing the remainder,  $X^2 = 47.88$ ,  $p = 0.001$ .

When considering frequency of observations in relation to the incident type (see table 4.9), this was found to have statistical significance ( $X^2 = 90.091$ ,  $p = < 0.003$ ).



Table 4.9, Frequency of General Observations and Incident Type

		Sets of Observations								Total
		x1	x2	x3	x4	x1	x2	x3	x4	
						incomp	incomp	incomp	incomp	
Incident Type	Trauma	2	32	29	16	8	17	24	17	145
	Psyc/MH	0	2	3	1	3	12	7	3	31
	Other	2	4	3	8	3	5	6	3	34
	Respiratory	1	8	6	12	0	10	12	13	62
	Cardiac	2	3	14	15	0	9	11	30	84
	Neurological	1	6	6	6	1	8	8	9	45
	GI	2	8	12	10	4	13	19	19	87
	Other	3	9	18	18	3	21	19	20	111
	Medical									
Total		13	72	91	86	22	95	106	114	599

Table 4.10 demonstrates this in a more approachable nature; percentages were calculated for each of the broad incident categories and those incidents where either one or four complete/incomplete sets of observations had been recorded. This ensured accurate interpretation in the context of widely varying frequencies between incidents.

Table 4.10, Percentage Frequency of Observations and Incident Type

Number of sets of complete / incomplete sets of observations	1 set of observations - % of PCR's Order of frequency in brackets	4 sets of Observations - % of PCR's Order of frequency in brackets
Trauma	6.9 (3)	22.6 (6)
Psych/MH	9.7 (2)	12.9 (7)
Other	14.7 (1)	32.3 (5)
Respiratory	1.6 (7)	40.4 (2)
Cardiac	2.4 (6)	53.6 (1)
Neurological	4.4 (5)	33.3 (4)
Gastrointestinal	6.9 (3)	33.3 (4)
Other Medical	5.4 (4)	34.2 (3)

Four (complete/incomplete) sets of observations were recorded most often with the 'Cardiac' group followed by 'Respiratory' and then 'Other Medical'; 'Neurological' and 'Gastrointestinal' were joint fourth and then 'Other'. The two incident types that had four sets of observations recorded the least were 'Psych/MH' and 'Trauma'. This is perhaps to be expected with the 'Psych/MH' patients who can sometimes prove challenging to monitor/assess.

The 'Trauma' group results are a little more surprising; this said, maybe the fact that most trauma is minor in nature, requires less intense assessment. This supposition is potentially given weight in looking at the recording of one set of observations only, where it is third highest.

Generally when comparing the number of sets of observations, incidents that had four sets recorded most often, tended to have the smaller numbers of one set only recorded; this stands to reason and feels intuitive.

#### 4.4.1 Additional Observations

In addition to the basic observations already mentioned, paramedics have further examination/assessment options to fully assess their patients.

#### 4.4.2 Haemoglucose test, Temperature and Pain scoring

Three of the more common additional observations are temperature, haemoglucose testing (HGT) and pain scoring. Of the clinical records reviewed, all three of these assessments were carried out in 53.3% (n=338) of incidents. There was a significant association between these three observations and geographical location: paramedics in urban locations carried out all three observations in 49.6% of incidents (n=149) with paramedics working in rural settings carrying these out in 63% of incidents (n=189),  $X^2 = 10.305$ ,  $p = 0.001$ . This can be seen in table 4.11

Table 4.11, Frequency of Additional Observations and Location

Location	Temp/HGT/Pain		Total
	Yes	No	
Urban	149	151	300
Rural	189	111	300
Total	338	262	600

Similarly to the 'general observations', when these additional observations are looked at by month (see table 4.12) there is no statistical difference,  $X^2 = 10.86$ ,  $p = 0.454$ .

Table 4.12, Frequency of Additional Observations and Month

Month	Temp / HGT / Pain		Total
	Yes	No	
January	34	16	50
February	29	21	50
March	23	27	50
April	32	18	50
May	26	24	50
June	25	25	50
July	23	27	50
August	27	23	50
September	31	19	50
October	30	20	50
November	30	20	50
December	28	22	50
Total	338	262	600

#### 4.4.3 Face, Arm, Speech Test (FAST)

Of all incidents reviewed, 44.5% (n=267) had the FAST recorded. When divided into separate locations, table 4.13 shows that 51.3% (n=154) of records from the urban area showed FAST recording compared to 37.6% (n=113) in rural areas. This was significant,  $X^2 = 10.797$ ,  $p = 0.001$ .

Table 4.13, Frequency of FAST and Location

	FAST		Total
	Yes	No	
Urban	154	146	300
Rural	113	187	300
Total	267	333	600

The table below (table 4.14) shows the recording of FAST by month. The proportion of FAST recorded or not recorded remains fairly steady throughout the year. There is no obvious trend. There are a few months where the difference between recorded or not recorded is bigger but this was not found to have significance,  $X^2 (11, n = 600) = 8.442$ ,  $p = > 0.05$  0.673.

Table 4.14, Frequency of FAST and Month

Month	FAST	
	Yes	No
January	25	25
February	23	27
March	18	32
April	26	24
May	24	26
June	27	23
July	18	32
August	21	29
September	18	32
October	22	28
November	22	28
December	23	27
Total	267	333

When FAST recording is compared to the number of neurological incidents recorded for the same months there is no obvious relationship.

#### 4.4.4 Electrocardiograms (ECGs)

ECGs were carried out in 38.5% (n=222) of all incidents reviewed. Within individual areas 26.6% (n=80) of urban records reviewed had 12 lead ECGs recorded compared with 47.3% (n=142) in rural settings. It is also clear to see that more 3 and 12 lead ECGs are carried out in the rural setting; these findings

can be seen in table 4.15. These findings were found to be significant,  $X^2 (3, n = 599) = 35.99, p = 0.000$

In broad terms this finding links to the frequency of cardiac incidents, where rural paramedics attend more than their colleagues in urban areas.

Table 4.15, ECG Frequency

Location	ECG (3/12 lead)				Total
	12 lead	3 lead	Type not specified	None	
Urban	80	1	1	217	300
Rural	142	8	0	150	300
Total	222	9	1	367	600

#### 4.5 Airway Intervention

Airway management, from basic to advanced methods, is a rarely practiced skill (see table 4.16). Only 1% (n=6) of records had any sort of airway intervention recorded. There was no record of any manual airway or advanced airway maintenance methods (endotracheal intubation) being used within all 600 records reviewed; all interventions were basic or intermediate.

When looking at differences between locations within airway management, due to the small numbers of interventions carried out, it is not possible to draw sound conclusions. Direct observation shows that within the sample, supraglottic airways (SGA) were used in both areas. The rural area used oropharyngeal airways three times, whereas the urban setting did use them at

all, but did make use of a nasopharyngeal airway. These figures were not found to be statistically significant,  $X^2 (3, n = 600) = 4.014, p = 0.260$ .

No significant difference was found when airway management was reviewed in the context of month,  $X^2 (33, n = 600) = 34.591, p = 0.392$ . This finding is corroborated by the data discussed earlier, demonstrating that there is no significant difference between month of the year and incidents attended.

Table 4.16, Airway Intervention Frequency

Intervention Type	Frequency	Percentage
Manual Airway Manoeuvres	0	0
Oropharyngeal Airway	3	0.5
Nasopharyngeal Airway	1	0.2
Supraglottic Airway	2	0.3
Endotracheal Intubation	0	0
No Intervention	593	98.8
Total	599	99.8

#### 4.6 Circulation Intervention

Data collection for circulation management focussed on intravenous (IV) cannulation and intraosseous (IO) access. In the majority of patients ( $n = 439$ , 73%) no intervention was carried out. IV cannulation was recorded as successful in 24.8% ( $n=149$ ) of patients and unsuccessful for 1.5% ( $n=9$ ). Intraosseous access was used successfully in two patients, less than



one percent of the sample. There was no record of any unsuccessful intraosseous attempts.

Use of the combat application tourniquet was also part of the data collected; however, none of the six hundred records reviewed showed utilisation of this device.

#### **4.6.1 Circulation Intervention and Location**

When geographical locations are applied to this, paramedics working in rural areas record a greater number of successful cannulations, they also record a greater number of unsuccessful cannulations than those in urban areas. Based on the clinical records, urban paramedics cannulate less but are more successful than their rural counterparts, with a success rate of 98.4% compared with 91.4%. Statistical significance was not demonstrated when cannulation, in isolation, was compared between locations,  $X^2 (1, n = 600) = 6.7, p = >0.05$ .

#### **4.6.2 Circulation Intervention and Incident Type**

Intravenous cannulation is often undertaken in adherence with clinical guidelines that suggest patients with specific provisional diagnoses/presentations should be cannulated. Table 4.17 demonstrates some predictable trends in line with this; cannulation was more frequent for trauma and GI patients compared to the Psych/MH group, possibly for analgesia. These results were found to have statistical significance,  $X^2 (14, n = 600) = 45.51, p = <0.05$ .

Table 4.17, IV Cannulation and Incident Type

Cannulation Attempted	Broad Incident Grouping							
	Trauma	Psych/ MH	Other	Respiratory	Cardiac	Neurological	GI	Other Medical
No	109	29	28	53	51	38	46	87
Yes	37	2	6	9	33	7	41	24

## 4.7 Immobilisation

This is a broad category and encompasses various skills and pieces of equipment. As the table below demonstrates it includes simple procedures such as placing a patients arm in a sling, to full spinal immobilisation including application of a pelvic binder.

From the records reviewed, 6.47% (n=39) of patients received some form of immobilisation. This finding is supported with review of provisional diagnosis codes, where thirty-five of which indicated a high likelihood for the need of some type of immobilisation.

### 4.7.1 Immobilisation Type Frequency

The most common immobilisation device to be used is the scoop/orthopaedic stretcher, generally used for neck/spinal immobilisation due to a potential spinal injury; this was followed by vacuum splints, used for limb injuries. Table 4.18 provides more detail about immobilisation type.

Table 4.18, Immobilisation Frequency

<b>Immobilisation Type</b>	<b>Frequency</b>
None	93.5% (n=561)
Scoop	4% (n=24)
Scoop/Pelvic binder	0.16% (n=1)
Sling	0.16% (n=1)
Spinal (no method recorded)	0.33% (n=2)
Vacuum Mattress	0.66% (n=4)
Vacuum Mattress/Pelvic binder	0.16% (n=1)
Vacuum splint (limb)	1% (n=6)

#### **4.7.2 Immobilisation and Location**

When geographical location was compared there was no discernible difference in terms the number of patients immobilised. There was also found to be no significant difference in relation to methods used between stations for immobilisation,  $X^2 (7, n = 600) = 9.66, p = > 0.208$ .

#### **4.7.3 Immobilisation and Season**

When immobilisation is reviewed in context of month of the year, similarly to incident and month of year there is no significant difference,  $X^2 (77, n = 600) = 68.86, p = 0.734$ .

## **4.8 Drug administration**

Drug administration data was recorded on 54.8% (n=329) of records; this ranged from basic routes such as oral to more complex routes such as intravenous.

### **4.8.1 Drug Administration and Location**

In the context of separate geographical locations, 50.6% (n=152) of records reviewed from the urban area showed drug administration compared to 58.6% (n=176) of records from the rural setting; this was shown to have statistical significance,  $X^2 (1, n = 600) = 3.558$ .  $p = <0.05$ .

### **4.8.2 Drug Administration and Time of Year**

Further examination of drug administration with month of the year shows no statistical significance,  $X^2 (11, n = 600) = 9.093$ ,  $p = >0.05$ . With usage remaining generally constant throughout the year and between stations. July and December appear to vary from the norm with a smaller difference between the stations; this does not appear to demonstrate anything specific and it is not possible to draw relevant conclusions.

### **4.8.3 Drug Administration Routes**

The number of times that each of the drug routes (available to paramedics) was recorded is shown in table 4.19. This has been further split into rural and urban locations.

Table 4.19, Drug Route and Location

<b>Drug Route</b>	<b>Frequency of Use - Urban</b>	<b>Frequency of Use - Rural</b>	<b>Frequency of use (Total)</b>
Inhaled	77	114	191
Intravenous	57	82	139
Oral	67	58	125
Sublingual	19	22	41
Nebulised	12	15	27
Intramuscular	1	9	10
Intraosseous	3	1	4
Rectal	0	1	1

This demonstrates that in order of frequency (highest to lowest), the top three drug routes are inhaled, intravenous and then oral. The top three drug routes are the same between both locations.

Commonly, multiple drug routes were recorded for the same patient contact, 46% (n=153) of all drug administrations had this multiple element. There was no statistical significance in any difference between locations and drug routes or time of year and drug route.

Similarly, review of the records demonstrated that not only is the use of multiple drug routes frequent, the use of multiple drugs is too; out of the 329 recorded administrations, 58.6% (n=193) involved administration of more than one drug.

## 4.9 Time with Patient

The histogram below (figure 4.12) gives an overall picture of the time spent with patients, regardless of geographical location. It demonstrates an overall, mean time spent with the patient of 59.46 minutes.

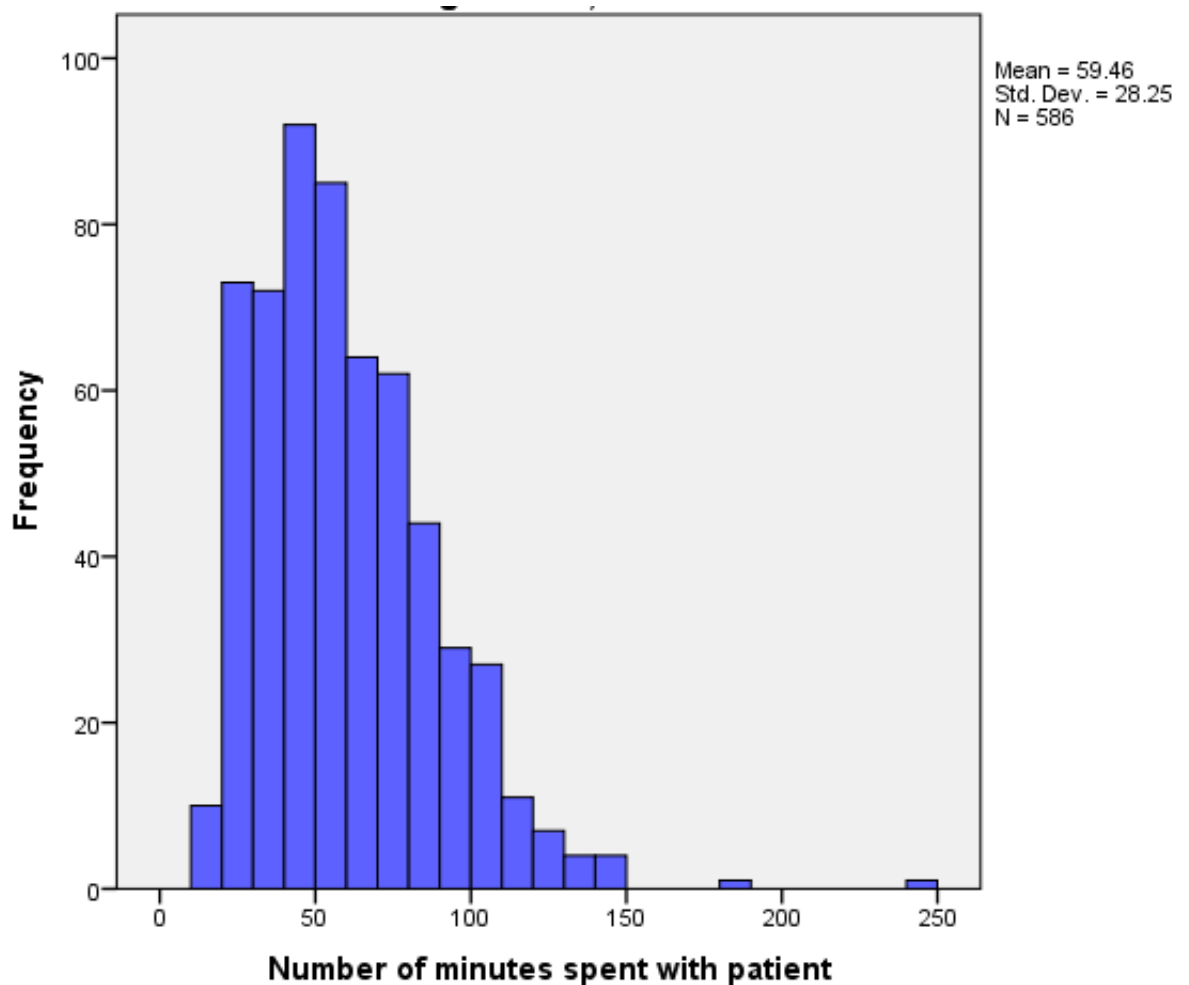


Figure 4.11, Time with patient

### 4.9.1 Time with Patient and Location

Figure 4.13 divides the two locations in relation to time spent with patients. It shows five separate time groupings that paint a predictable picture of the locations. The table suggests rural paramedics generally spend more time with

their patients; something found to be significant,  $X^2 (6, n = 586) = 183.653, p = 0.000$

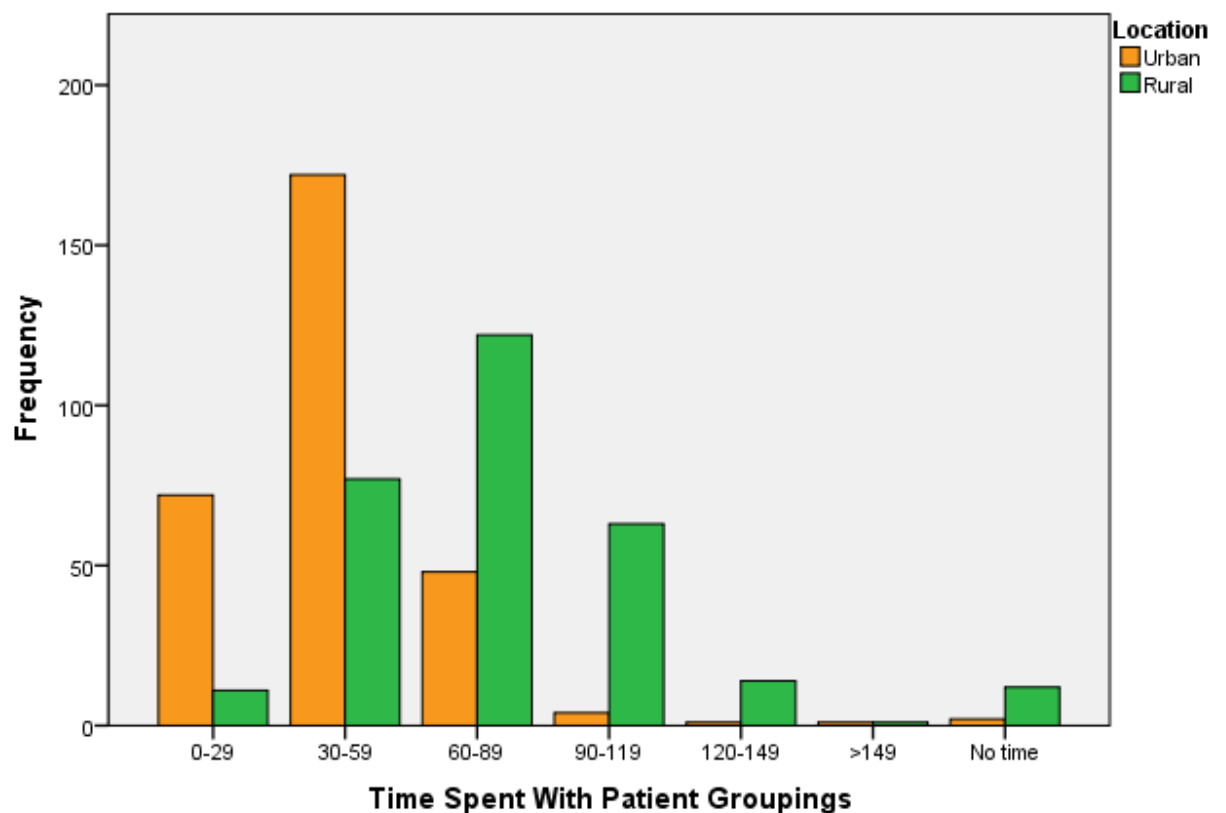


Figure 4.12, Time with Patient and Location

#### 4.9.2 Time with Patient and Age Grouping

Analysis of the time spent with patient and broad age group demonstrated no significant differences in relation to the possibility that various age ranges had associated increase/reduced patient contact time  $X^2 (21, n = 586) = 67.802, p = < 0.01$ . Indirectly this also re-affirms the fact that the age groups attended within each area are generally the same, with no significant difference (despite the trend noted in the age section). This can be seen in table 4.20

Table 4.20, Time with Patient and Age Grouping

	<b>Time Grouping</b>				
<b>Age Grouping</b>	<b>0-29</b>	<b>30-59</b>	<b>60-89</b>	<b>90-119</b>	<b>120-149</b>
	(83 patients)	(247 patients)	(170 patients)	(66 patients)	(15 patients)
<b>Paed/Adolescent</b>	17	23	8	3	0
<b>Adult</b>	31	60	27	9	4
<b>Middle Age</b>	17	63	40	17	1
<b>Older Adult</b>	10	57	53	14	5
<b>Elderly</b>	8	44	42	23	5

No significant difference was found during comparison of month/season and time spent with patient,  $X^2$  (96,  $n = 586$ ) = 691.618,  $p = 0.000$ .

#### 4.9.3 Time with Patient and Interventions

The table below (table 4.21) shows the percentage of patients within broad age groupings that received interventions of some form during their contact with a paramedic. None of the interventions when compared to time with patient demonstrated statistical significance, largely due to the high frequency of nil values. There were four further time groupings but they only account for two patients and were therefore not included in this table due to the lack of statistical impact.



Table 4.21, Time with Patient and Intervention

	<b>Time Grouping</b>				
<b>Intervention</b>	<b>0-29</b> (83 patients)	<b>30-59</b> (249 patients)	<b>60-89</b> (170 patients)	<b>90-119</b> (67 patients)	<b>120-149</b> (15 patients)
<b>General Obs</b>	100%	99.5%	100%	100%	100%
<b>Additional Obs</b>	37.3%	49.7%	67.6%	67.1%	80%
<b>FAST</b>	40.9%	46.1%	47%	38.8%	53.3%
<b>12 lead ECG</b>	20.7%	31.7%	44.1%	58.2%	60%
<b>Airway</b>	0%	1.6%	0.5%	0%	0%
<b>IV cannulation</b>	9.6%	23.2%	31.7%	38.8%	40%
<b>Drug admin</b>	36.1%	50.6%	61.7%	68.6%	66.6%
<b>Immobilisation</b>	3.6%	6%	8.8%	4.4%	6.6%

The interventions shown are those that data was collected for. Airway management is worthy of mention as it accounts for only one percent of all records reviewed; as a result, little meaning can be drawn from the data. Despite the afore mentioned potential issues and exclusions, as well as the lack of statistical significance, the time groupings shown here do illustrate a general picture within the data collected. This picture showed that, in general, the longer the time spent with a patient, the more likely the patient was to have an intervention of some sort carried out during their contact with a paramedic.

#### **4.10 Discussion Phase One**

The results from phase one of the study fulfilled the stated aims from chapter three, they identified the incident types UK paramedics are dispatched to, as well as establishing the frequency of technical skills associated with paramedic practice, allowing exploration of any variance in the incident frequencies and skills usage, based on location, time of year and age.

The data painted a comprehensive picture of paramedic practice within an area of the of the UK, in particular, highlighting the vast variety of incidents attended and the skills, of low to high complexity, that they may be required with varying frequency (AACE, 2011; Bradley, 2005; CoP, 2018a; CoP, 2019; NAO, 2010).

These aspects relate to previous discussion in chapter one and future more detailed analysis in chapter six, highlighting the difficulty faced by UK paramedics in maintaining competence when practising the full range of skills available to them (Arksey & O'Malley, 2005; Ericsson, 2008; Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012). It identifies the occurrence of broad and specific incident types, showing that these two findings are distinct and offer different viewpoints of the situation when the nebulous broad grouping is compared with the highly specific incident codes.

The results, as previously mentioned identify the frequency of technical skills practiced by non-specialist paramedics. This showed the very infrequent nature of interventions such as airway management, alongside the comparatively more frequent intervention of intravenous cannulation, attempted in almost a third of patients, and drug administration, carried out in in approximately half all records reviewed.

Factors such as season, location and age were analysed within this phase.

Significant differences were limited; however, some long-held anecdotal beliefs

were upheld, such as an increase in attendance at chest infections throughout winter.

Significant differences were identified with some of the data, such as the age split between rural and urban locations, with paramedics working in urban areas having more regular contact with younger patients, this feels intuitive, with urban areas often being associated with younger populations. Also, linked to age, the results identified variation in the incidents most commonly attended for different age groups, an example of which was the association between the 'middle age' group and the MH/Psych incident type. General sets of observations were completed less often for younger patients, possibly because of the incident types they tend to be associated with and different assessment practices (Woollard & Jewkes, 2004).

Analysis of time spent with the patient highlighted an interesting, seemingly predictable trend. Paramedics spent more time with patients in rural settings than urban, and although not significant, more interventions were performed when the time spent with the patient was greater.

In its own right the results from phase one offer insight into UK paramedic practice; however, in the context of this study the results can be further explored through the literature. This highlights the very occasional nature of some skills and incidents, along with the dynamic nature of the role, the situation can cause potential issues with competence and confidence of paramedics, having further impact on maintenance of professional standards like the Health and Care Professions Council, Standards of Proficiency (HCPC, 2014). The potential issue created invites consideration of theories such as the conscious/competence matrix (Higginson & Hicks, 2006) the Dunning Kruger effect (Kruger & Dunning, 1999) and experience curves (Pusic *et al.*, 2012). All

of which relate to the ability of paramedics to safely and confidently practice technical skills that are infrequent in their nature. This consideration will feed into phase two of this research. Also warranting consideration is education of paramedics, in relation to how they gain the knowledge/experience that they need to demonstrate competence, as well as the 'weighting' of time allocated to various conditions, incidents and skills (AACE, 2011; Bradley, 2005; CoP, 2019; Pusic *et al.*, 2012).

The identification of frequent/infrequent technical skills in phase one, combined with the explanation of skill complexity offered in chapter two informed phase two of the study in establishing the following;

- Complex/frequent – intravenous cannulation
- Complex/infrequent – Intermediate/advanced airway management (supraglottic airway/endotracheal intubation)
- Simple/frequent – Drug administration-Oxygen administration
- Simple/infrequent – Basic airway manoeuvres (Manual airway maintenance/basic airway adjuncts)

These skills were carried forward to the second phase of the study so actual and perceived competence and confidence in each of them could be explored.

#### **4.11 Summary**

This chapter reviewed the results from phase one of this study, which sought to establish the frequency of incidents attended and skills used by paramedics.

When incidents were reviewed as broad groups, trauma was the most frequent, followed by 'other medical' and 'gastrointestinal'; the commonality was that these are all nebulous groups. Review of the more specific provisional diagnosis codes showed a different picture where trauma only appeared once

in the top five and only in the urban setting. The most common provisional diagnosis code was 'acute abdomen' followed by 'other medical' and then 'acute coronary syndrome', again these are still potentially broad in their nature. Although there was slight variance, there was no significant difference between the incident frequency and urban/rural areas or time of year.

This chapter demonstrated a wide variety of results in relation to the frequency of incidents attended and skills used by paramedics; however, there were a few stand out results such as the stark infrequency of incidents such as major trauma and cardiac arrest. Clinical skills like airway management and intraosseous access were also shown to be very infrequent. Conversely, intravenous cannulation and drug administration were shown to be relatively commonplace. No difference with location was demonstrated here.

The results from phase one did suggest that some of the skills used, such as intravenous access and drug administration may be more linked to provisional diagnosis and/or time spent with patient than aspects such as time of year or location.

## CHAPTER Five: Phase Two Results

### 5.0 Introduction

This phase of the study sought to establish whether paramedic performance was affected by the frequency and/or complexity of the skill they were practicing; additionally, it looked at individual clinician's perception of their performance in practising these skills, both prior to and immediately following participation in a short clinical scenario. The statistical significance level for this phase was set at  $P = <0.05$ , therefore significant results had a less than 5% probability they occurred by chance.

The skills used for the scenario and their frequency/complexity can be seen in table 5.1.

Table 5.1 – Skill Allocation for Phase Two Scenario

	<b>Simple</b>	<b>Complex</b>
<b>Frequent</b>	Oxygen Administration	Intravenous Cannulation
<b>Infrequent</b>	Basic Airway Maintenance – manual manoeuvres and basic airway adjuncts	Intermediate/Advanced Airway Maintenance – SGA device and ET Tubes

Further explanation of the skills used was given in chapter three.

In this chapter the results of phase two of this study are presented. Skills performance and perception of own performance will be analysed on relation to demographic data. The chapter will finish with discussion of the data reported and a summary.

## **5.1 Quantitative Data**

The following sections will report the quantitative data from phase two of this study.

### **5.1.1 Demographic Information**

Sixty-nine participants took part in phase two of this study (51 male, 18 Female), median age range was 20-29yrs, accounting for almost 50% of participants. An average of 4.14yrs (range 0.08-25yrs) as a paramedic had been spent in clinical practice.

In relation to education, 81.16% of participants were university educated (56 University, 13 IHCD) and 15.95% (n=11) of participants were current Practice Educators (at the time of data collection). Table 5.2 shows the demographic information collected, in full.

Table 5.2, General Demographic Information

Demographic	Value	Frequency
Gender	Male	73.91% (n=51)
	Female	26.09% (n=18)
Age	20-29	47.83% (n=33)
	30-39	26.09% (n=18)
	40-49	21.74% (n=15)
	50-59	4.35% (n=3)
	>60	0
Years as a Paramedic	Average (mean)	4.14 years
	Range	0.08-25 years
Career Breaks	Number of participants	10.14% (n=7)
	Years (mean)	1.14 years
Training / Education Route	IHCD	18.84% (n=13)
	University	81.16% (n=56)
Practice Educator	Yes	15.94% (n=11)
	No	84.06% (n=58)

### 5.1.2 Pre/Post Observation Self-Rating Confidence and Competence Scores

Pre-observation self-reported competence and confidence scores for the observed skills showed a range of 3-10. Post observation scores showed a wider range of 0-10, table 5.3 shows the full pre/post self-reported competence and confidence score ranges. Average pre/post observation self-rated



competence and confidence scores, along with interquartile ranges (IQR) can also be seen in table 5.4.

Table 5.3, Pre/post Observation Confidence and Competence Ranges

	Pre-observation ranges		Post-observation ranges	
	Confidence	Competence	Confidence	Competence
<b>Oxygen Administration</b>	<b>5-10</b>	<b>5-10</b>	<b>6-10</b>	<b>0-10</b>
<b>IV Cannulation</b>	<b>4-10</b>	<b>4-10</b>	<b>4-10</b>	<b>4-10</b>
<b>Basic Airway Management</b>	<b>5-10</b>	<b>5-10</b>	<b>1-10</b>	<b>2-10</b>
<b>Intermediate/Advanced Airway Management</b>	<b>4-10</b>	<b>3-9</b>	<b>3-10</b>	<b>2-10</b>

Comparison of the self-rated competence and confidence scores, for the four skills in phase two, using Friedman's Test, indicated significant difference between them, this can be seen in table 5.4. This was true when considering both confidence and competence for each skill, as well as pre-observation and post observation. Oxygen administration showed the highest pre-scenario confidence and competence self-rating scores and intermediate/advanced airway maintenance showed the lowest in both pre and post observation self-reporting.

Table 5.4, Self-Rating Scores for Confidence and Competence

	Pre - Observation				Post - Observation			
	Confidence (median)	IQR	Competence (median)	IQR	Confidence (median)	IQR	Competence (median)	IQR
Oxygen administration	8.84	8-10	8.74	8-10	8.33	8-9	8.10	7-9
IV Cannulation	7.68	7-9	7.55	7-8	7.86	7-9	7.68	7-9
Basic Airway Manoeuvres	7.49	7-8	7.30	6.25-8	7.32	7-8	7.17	6-8
Intermediate/Advanced Airway Management	6.69	5.5-8	6.61	6-7	7.20	6-8	7.01	6-8
Friedman test result	$\chi^2$ (3, n=69) = 97.612, p<0.001		$\chi^2$ (3, n=69) = 100.577, p<0.001		$\chi^2$ (3, n=69) = 45.302, p<0.001		$\chi^2$ (3, n=69) = 41.937, p<0.001	

Further examination of data, using Wilcoxon's Signed Rank test, showed significant differences between pre/post self-reported scores in oxygen administration and intermediate/advanced airway maintenance, for both confidence and competence. A Bonferroni correction was carried out due to the number ( $n=8$ ,  $p=0.05/8=0.00625$ ) of statistical tests used in the analysis of the data in table 5.4; this prevented a type 1 error. The Bonferroni correction resulted in the comparison of competence not being significant. Specifically, in the context of table 5.4, pre-observation self-reported scores were higher than post-observation for basic airway manoeuvres and oxygen administration, this finding was reversed with post observation scores being higher than pre-observation for the other skills, table 5.5 shows the

differences between all pre/post observation scores, with the Bonferroni correction.

Table 5.5, Comparison of Pre/Post Self-Reported Scores

Self-report topic	Wilcoxon	Significant pre/post observation difference (p=0.05)	Significant pre/post observation difference with Bonferroni correction (p=0.00625)
Basic Airway Maintenance conf	Z = -0.387, p > 0.05	No	No
Basic Airway Maintenance comp	Z = -0.375, p > 0.05	No	No
Oxygen Administration conf	Z = -3.720, p <0.001	Yes	Yes
Oxygen administration comp	Z = 3.421, p <0.05	Yes	No
Intermediate/advanced Airway Maintenance conf	Z = -4.351, p <0.001	Yes	Yes
Intermediate/advanced Airway Maintenance comp	Z = -3.709, p <0.001	Yes	Yes
IV Cannulation conf	Z = -1.540, p >0.05	No	No
IV Cannulation comp	Z = -1.449, p >0.05	No	No

Note: conf = confidence; comp = competence

Comparison of pre/post-observation confidence and competence, in all skills, using Spearman's rank order for each skill did identify strong positive correlation, this can be seen in table 5.6.

Table 5.6 – Pre/post-Observation Skills Confidence and Competence Correlation

	<b>Pre-Observation Skills Confidence and Competence Correlation (using Spearman's coefficient)</b>	<b>Post-Observation Skills Confidence and Competence Correlation (using Spearman's coefficient)</b>
<b>Basic Airway Maintenance</b>	$r_s +0.806, n=69, <0.001$	$r_s +0.919, n=69, <0.001$
<b>Oxygen Administration</b>	$r_s +0.806, n=69, <0.001$	$r_s +0.777, n=69, <0.001$
<b>Intermediate/Advanced Airway Maintenance</b>	$r_s +0.742, n=69, <0.001$	$r_s +0.868, n=69, <0.001$
<b>IV Cannulation</b>	$r_s +0.841, n=69, <0.001$	$r_s +0.810, n=69, <0.001$

### 5.1.3 Performance Scores

In contrast to pre-assessment self-rated confidence scores, the individual performance scores rated by the researcher were highest (indicating better performance) for basic airway maintenance followed by intravenous cannulation and then intermediate/advanced airway maintenance, with the lowest score being oxygen administration, see table 5.7.

Table 5.7 – Performance skills scores/ranking

	<b>Ranking – 1 = highest score, 4=lowest score</b>	<b>Mean % Score</b>	<b>% Range</b>
<b>Basic Airway Maintenance</b>	1	79.30	14.29-100
<b>IV Cannulation</b>	2	77.40	44.44-100
<b>Intermediate/Advanced Airway Maintenance</b>	3	74.32	0-100
<b>Oxygen Administration</b>	4	58.37	0-80.94

The Shapiro Wilkes test showed that performance scores had a skewed distribution and therefore comparisons were made using a non-parametric test. Friedman's test showed significant difference between the scores  $X^2 (3, n=69) = 67.260, p<0.001$ .

During completion of the post-scenario questionnaire, separately to scoring confidence and competence, participants were asked to say which of the skills they found easiest and which most difficult, as seen in table 5.8. Over half of participants deemed oxygen administration as the easiest skill, a finding reflected in pre/post self-reported confidence and competence scores that were all highest for oxygen administration; however, this was not reflected in the researcher observed performance scores where it was the lowest scoring skill.

Table 5.8, Post Performance Easiest/Most Difficult Skills with Ranking

<b>Skill</b>	<b>Easiest</b>	<b>Ranking – 1 = highest score, 4=lowest score</b>	<b>Most Difficult</b>	<b>Ranking – 1 = highest score, 4=lowest score</b>
<b>Oxygen administration</b>	52.17% (n=36)	1	11.59% (n=8)	4
<b>IV Cannulation</b>	24.64% (n=17)	2	31.88% (n=22)	2
<b>Basic Airway Maintenance</b>	10.14% (n=7)	4	20.29% (n=14)	3
<b>Intermediate/Advanced Airway Maintenance</b>	11.59%(n=8)	3	33.33 (n=23)	1
<b>Not Recorded</b>	1.45% (n=1)		2.90% (n=2)	

Pre and post observation the changes in self-rating competence and confidence ranking, alongside the actual performance observation scores can be seen in table 5.9. Points of interest are that self-reporting scores for confidence/competence were highest for oxygen administration but observation scores for the same skill were the lowest. Conversely, competence self-perception and confidence scores were second lowest for basic airway maintenance; however, observation scores for this skill ranked the highest.

Table 5.9, Comparison of Confidence, Competence and Observation Rankings

<b>Skill</b>	<b>Confidence/ Competence</b>	<b>Pre- observation self- perception</b>	<b>Observation score</b>	<b>Post- observation self- perception</b>
Ranking – 1 = Highest self-perception / score				
<b>Oxygen Administration</b>	Confidence	1	4	1
	Competence	1		1
<b>IV Cannulation</b>	Confidence	2	2	2
	Competence	2		2
<b>Basic Airway Maintenance</b>	Confidence	3	1	3
	Competence	3		3
<b>Intermediate/Advanced Airway Maintenance</b>	Confidence	4	3	4
	Competence	4		4

#### 5.1.4 Correlation of Demographic Data, Self-Reported Confidence and Competence and Total Observation Scores

Comparison of demographic data and observation scores using Pearson's coefficient showed a correlation between the Practice Educator/non-Practice Educator group and two of the skills, these were positive with oxygen administration ( $r_s +0.268$ ,  $n=69$ ,  $p<0.05$ ) and negative with intermediate/advanced airway maintenance ( $r_s -0.249$ ,  $n=69$ ,  $p<0.05$ ). These results therefore suggest that Practice Educators (PEd) scored higher on the oxygen administration element of the scenario and lower on the intermediate/advanced airway management.

The above findings were explored further using a Mann-Whitney U test, this highlighted a significant difference between oxygen administration observation scores and PEd/non-PEd. PEd (Md = 66.67, n=11) and non-PEd (Md = 57.14, n=58),  $U = 185.000$ ,  $z = -2.209$ ,  $p = <0.05$ .

In relation to intermediate/advanced airway maintenance, a significant difference was also found when a Mann-Whitney test was applied, PEd (Md = 83.33, n=11) and non-PEd (Md = 83.33, n=59),  $U = 198.00$ ,  $z = -2.055$ ,  $p = <0.05$ .

Figure 5.1 shows a box plot for the mean oxygen administration observations scores. Figure 5.2 shows the same for intermediate/advanced airway maintenance and demonstrates the difference across the scores, despite the median for this skill and PEd/non-PEd being the same.

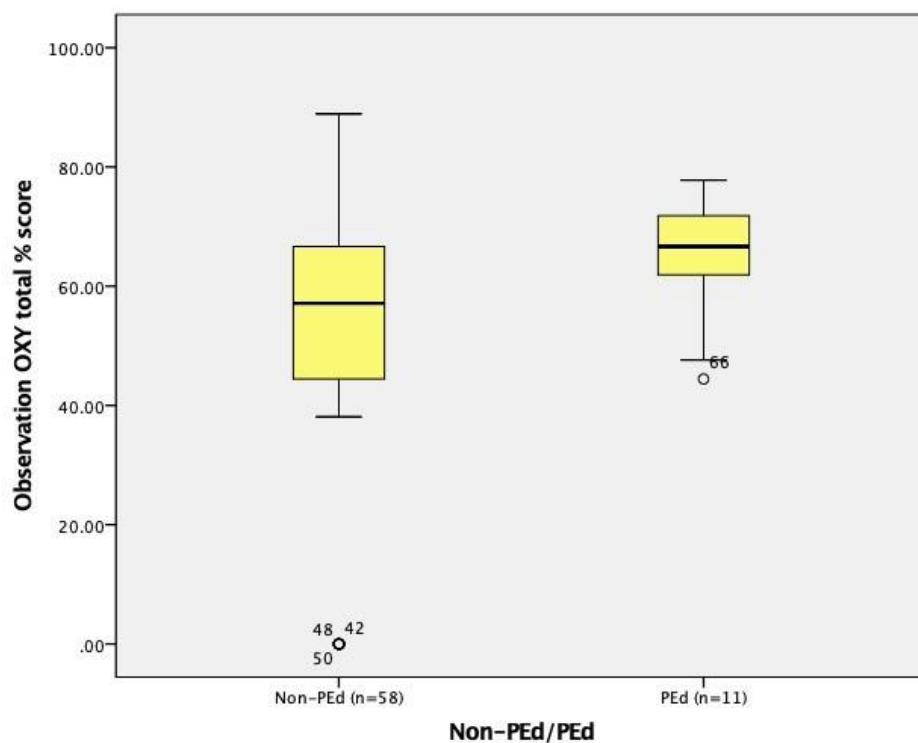


Figure 5.1, Oxygen Administration Mean Scores Comparison



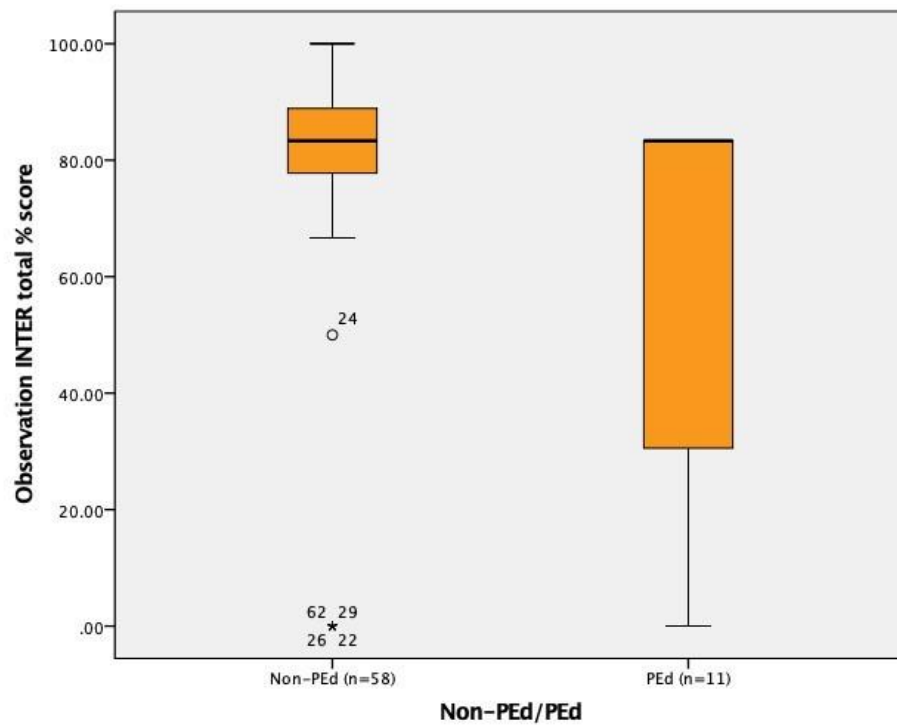


Figure 5.2, Intermediate/advanced Airway Management Mean Scores Comparison

Spearman's rank order showed no relationship between pre-observation self-reported competence and confidence, and performance scores. When performance was compared with post-observation self-reported confidence and competence scores there was a significant positive correlation between intermediate/advanced airway maintenance performance and post-observation competence/competence, as shown in table 5.10.

Table 5.10 – Pre/Post-Observation Skills Confidence and Competence with  
Scenario Scores Correlation

	<b>Pre-Observation Skills Confidence and Competence with scenario scores correlation (using Spearman's coefficient)</b>	<b>Post-Observation Skills Confidence and Competence with scenario scores correlation (using Spear man's coefficient)</b>
Basic Airway Maintenance conf	$r_s +0.167, n=69, >0.05$	$r_s +0.158, n=69, >0.05$
Basic Airway Maintenance comp	$r_s -0.010, n=69, >0.05$	$r_s +0.175, n=69, >0.05$
Oxygen Administration conf	$r_s +0.044, n=69, >0.05$	$r_s -0.041, n=69, >0.05$
Oxygen Administration comp	$r_s +0.043, n=69, >0.05$	$r_s +0.049, n=69, >0.05$
Intermediate/Advan ced Airway Maintenance conf	$r_s +0.180, n=69, >0.05$	$r_s +0.273, n=69, <0.05$
Intermediate/Advan ced Airway Maintenance comp	$r_s -0.095, n=69, >0.05$	$r_s +0.275, n=69, <0.05$
IV Cannulation conf	$r_s -0.017, n=69, >0.05$	$r_s -0.063, n=69, >0.05$
IV Cannulation comp	$r_s +0.026, n=69, >0.05$	$r_s -0.017, n=69, >0.05$

### 5.1.5 Deviation from Guidelines/Standard Operating Procedures

During the observed scenario general comments were also recorded for each candidate, this highlighted deviation from guidelines with specific parts of practice, there were two common trends identified;

- Incomplete consent prior to oxygen administration and intravenous cannulation.
- Elements of procedural skills missed, or completed out of sequence, such as tourniquet release during cannulation or airway placement verification procedure.

During attainment of consent for oxygen administration in the scenario, 57% (n=39) of participants scored 0 or 1 out of an available 3 marks. This low score

means that implied consent was achieved but there was no verbal confirmation from the conscious patient. The maximum of 3 marks was only scored by 1% of participants (n=1). When preparing for IV cannulation, a smaller number, 30% (n=21) of participants scored 0 or 1. In contrast slightly more, 6% (n=4) scored the maximum of 3 marks, indicating that consent was achieved in full.

When considering elements of procedural skills omitted, issues were identified with the use of the tourniquet during IV cannulation in 30% (n=21) of the scenarios; these were largely due to releasing it in an incorrect order, ie following removal of the stylet, opposed to prior to removal of the stylet, as is stated in the 'standard'.

During intermediate/advanced management of the airway, 62% (n=43) of candidates carried out incomplete verification of airway placement; the main issues highlighted were failure to use end tidal CO<sub>2</sub> monitoring and/or auscultate the lungs to ensure bilateral air entry. Both these actions are required by local ambulance trust guidelines/standard operating procedures.

## **5.2 Survey Open-Ended Question Data**

During the pre/post observation questionnaire, participants were given the chance to provide a response to short answer questions, these related to their confidence/competence and the reason it may be high or low.

### **5.2.1 Development of Themes**

The answers provided were initially analysed to develop nine broad themes that spanned all of the short answer questions, these can be seen below;

- Experience/exposure to skills/situations
- Development of practice

- Education type/frequency
- Personal (FTP - tiredness, illness etc)
- Evidence base/guidelines
- Environment/scene
- Recent success/failure/feedback
- Support
- Complexity

Following development of these nine general themes the most frequent were identified, these can be seen in table 5.11. The highlighted themes were those that appeared three or more times, or, were the most frequently occurring where there weren't three or more occurrences.

Table 5.11 – Most Frequent General Themes (with ranking)

<b>General Theme</b>	<b>Frequency of mention</b>	<b>Ranking (1 most frequent)</b>
Education type/frequency of education opportunity	17	1
Personal (FTP - tiredness, illness etc)	15	2
Experience/exposure to skills/situations	14	3
Environment/scene	10	4

### **5.3 Exploration of Themes**

Exploration of the four most frequent themes from the nine above enabled insight into factors affecting competence and confidence, as shown in the following sections that include direct quotes from the pre/post scenario questionnaires.

#### **5.3.1 Experience/Exposure to Skills/Situations**

This was the fourth most frequently identified theme, it was particularly prevalent in relation to confidence. Participants comments within this theme were both directly and indirectly linked to their level of practice experience and/or exposure to various skills and situations. When asked what factors affected confidence, one response was:

‘Lack of practice, both real and simulated.’ (Participant 9)

In a more direct response, when asked the same question, another respondent wrote:

‘Past experience. Frequency of skill use.’ (Participant 68)

This theme was not aligned to solely negative or positive experiences of participants.

#### **5.3.2 Personal (personality, FTP - tiredness, illness etc)**

This was the next most frequent theme and was commonly identified in relation to factors affecting confidence and competence. It is a broad theme relating to personality, health and/or perception of ability. When asked about confidence, one participant wrote:

‘Individual personality. Recent circumstances. General stress.’

(Participant 51)

Another response although different in wording offered similar aspects:

‘Time = tiredness (too many over-runs). Fear of embarrassment - although I do ask questions, seek help sometimes, I feel this may go against me.’ (Participant 49)

### **5.3.3 Environment/Scene**

This theme was often seen when consideration was being given to confidence, it was used by participants in a largely negative context. It was the second most common theme and encompassed the obvious factors such as location, and family and friends of the patient, one response read:

‘Environmental factors such as being in public (in front of lots of people).’  
(Participant 38)

In addition the theme also included working/professional relationships with other clinicians:

‘Incident going wrong. Worsening scenario. Overbearing medical authority.’  
(Participant 55)

### **5.3.4 Education Type/Frequency**

This was the most frequent theme and appeared most broadly in relation to both confidence and competence, in both positive and negative terms. The theme included various aspects such as route to paramedic registration, a response relating to this read:

‘Practice on a regular basis, i.e. cannulation. Practice drills at university, they stick in your mind.’ (Participant 26)

As well as the more obvious education route aspect opportunities to engage in further training/education were also identified within this theme as is shown with the following participant responses:

‘Lack of ‘in house’ tuition/Statutory Mandatory Education days.’

(Participant 11)

‘Not doing enough CPD due to time constraints.’ (Participant 45)

### 5.3.5 Frequency of Themes

In relation the qualitative data themes identified in section 5.3, table 5.11 shows the most common theme for each of the six qualitative questions.

Table 5.12, Common Themes for Short Answer Questions Regarding  
Confidence/Competence

Question	Most frequent theme
<b>Pre scenario</b>	
What factors affect your confidence?	Experience/Exposure to skills/situations
What factors affect your competence?	Personal (FTP - tiredness, illness etc)
<b>Post Scenario</b>	
If your confidence was low, why?	Environment/scene
If your competence was low, why?	Education type/frequency
If your confidence was high, why?	Education type/frequency
If your competence was high, why?	Education type/frequency

Looking at the most frequent themes perhaps over-simplifies the picture;  
therefore, table 5.13 shows all of the themes and their frequency for each of the  
questions that elicited them.

Table 5.13 – All Qualitative Themes Identified

Questions	Theme		Frequency of theme	High frequency themes
Pre Observation Questionnaire				
What factors affect your confidence?	1	Experience/Exposure to skills/situations	8	8 x Experience/Exposure to skills/situations 7 x Personal (FTP - tiredness, illness etc) 6 x Environment/scene 5 x Education type/frequency
	2	Development of practice	2	
	3	Education type/frequency	5	
	4	Personal (FTP - tiredness, illness etc)	7	
	5	Evidence base/guidelines	2	
	6	Environment/scene	6	
	7	Recent success/failure/feedback	2	
	8	Support	1	
	9	Complexity	1	
What factors affect your competence?	1	Experience/Exposure to skills/situations	1	3 x Education type/frequency 8 x Personal (FTP - tiredness, illness etc)
	3	Education type/frequency	3	
	4	Personal (FTP - tiredness, illness etc)	8	
	5	Evidence base/guidelines	1	
	7	Recent success/failure/feedback	1	
	8	Support	1	
	9	Complexity	1	
Post Observation Questionnaire				
Questions	Theme		Frequency of theme	High frequency themes
If your confidence was low, why?	1	Experience/Exposure to skills/situations	3	4 x Environment/scene 3 x Experience/Exposure to skills/situations
	3	Education type/frequency	1	
	4	Personal (FTP - tiredness, illness etc)	1	
	5	Evidence base/guidelines	1	
	6	Environment/scene	4	



	7	Recent success/failure/feedback	1	
	8	Support	1	
If your competence was low, why?	3	Education type/frequency	3	3 x Education type/frequency
	4	Personal (FTP - tiredness, illness etc)	2	
<b>Post Observation questionnaire</b>				
Questions	Theme		Frequency of Theme	High Frequency Themes
If your confidence was high, why?	1	Experience/Exposure to skills/situations	3	4 x Education type/frequency 3 x Experience/Exposure to skills/situations
	3	Education type/frequency	4	
	4	Personal (FTP - tiredness, illness etc)	1	
	5	Evidence base/guidelines	1	
	9	Complexity	1	
If your competence was high, why?	3	Education type/frequency	2	2 x Education type/frequency
	7	Recent success/failure/feedback	1	

## 5.4 Discussion Phase Two

The plan for phase two of this study drew on the data from phase one, where the frequency of technical skills used was identified, this was combined with the earlier identification, in chapter three, of paramedic skills that were graded as complex or simple, using rationale based on clinical grade and the existence of an accepted standard of practice within the profession.

Broadly speaking, the participants for phase two were, on average, within the first five years of their paramedic careers and from a university educated background. The reason for this may be that graduate paramedics are both more research familiar, and therefore willing to participate, and also that they are more comfortable with taking part in simulation.

Prior to, and following the clinical scenario, participants completed questionnaires allowing exploration of the proposition mentioned previously,

that the unskilled are unable to recognise issues within their own practice (Higginson & Hicks, 2006; Kruger & Dunning, 1999). Phase two of this study did not necessarily support this and perhaps aligned better with the concept that infrequent practice would result in degradation of competence (Pusic *et al.*, 2012). Furthermore, focussed practise is required to develop competence (Ericsson, 2004). Another factor highlighted during phase two was the complexity of clinical skills and the potential for them to be considered as solely technical. This was demonstrated well with the lack of attention given to consent by participants.

There was significant difference in self-reported competence/confidence scores between each of the distinct skills. Pre and post scenario self-reported scores for confidence and competence were significantly different in both oxygen administration and intermediate/advanced airway maintenance; oxygen administration falling post scenario and intermediate/advanced airway maintenance rising. This identifies that something during the scenario made candidates feel differently when completing the post observation questionnaire, perhaps indicating insight into knowledge and performance, refuting the above literature (Dunning *et al.*, 2003; Higginson & Hicks, 2006). Comparison of pre and post self-reported competence correlated positively, as did confidence.

A significant difference was also shown between the actual scenario scores for each of the distinct skills, indicating that participants did view them differently in terms of difficulty. Interestingly the self-reported scores did not align with the actual scenario scores. Pre observation self-report scores for competence and confidence, and actual performance showed no correlation. When the same post observation self-report scores were analysed, a positive correlation was identified for intermediate/advanced airway maintenance.

In addition to this self-reported and scenario data there were some short answer, open questions that were designed to obtain some basic reasoning for high or low competence/confidence, responses from these open questions were distilled into four broad categories

- Experience/Exposure to skills/situations
- Personal (FTP - tiredness, illness etc)
- Environment/scene
- Education type/frequency

The data from all aspects of phase one and two will be used in chapter 6 to explore the literature relating to self-perception and the Dunning Kruger effect (Kruger & Dunning, 1999), but also in relation to learning/education strategies such as deliberate practice and forgetting curves (Pusic *et al.*, 2012).

## **5.5 Summary**

Chapter five reported on the data collected during the second phase of this study. It offered a demographic overview of the 69 participants, highlighting that these were largely young university graduates, with a mean time practicing as a paramedic of approximately four years.

Comparison of self-reported competence and confidence scores between the selected clinical skills showed significant difference, indicating that participants perceived them to differ in their complexity. When pre/post scenario self-reported scores were tested, significant difference was also found with oxygen administration and intermediate/advanced airway management, perhaps suggesting that something happened during the clinical scenario with these skills. Further review of these pre/post scenario scores showed correlation between competence and confidence across all.

Analysis of the scenario performance scores showed that participants did not score highest with the skills where they reported the highest confidence and competence. The two skills that stood out were oxygen administration which was rated the easiest but had the lowest scenario performance scores, and basic airway maintenance, that was rated the third most difficult skill but had the highest scenario scores.

Review of the demographic data with the actual performance scores and self-reported scores showed correlation with participants who were practice educators, who scored higher results when administering oxygen but lower when performing intermediate/advanced airway management.

Exploration of the open ended questions from the questionnaires highlighted some common themes that participants reported as affecting their confidence/competence, such as educational, personal, experience and environmental.

## **Chapter Six: Discussion**

### **6.0 Introduction**

This chapter examines the key results from both phases of this study, in relation to the aims and objectives. Discussion draws on relevant literature to enable exploration of the theoretical contributions made by this research. Following on from this, conclusions are drawn about the implications for paramedic practice, as well as future education and research. The main findings discussed in the following section relate to the paramedic role and the skills expected of them in contemporary UK practice; this will include discussion around what constitutes a skill, the prevalence of incident types and the frequency of certain skills. Discussion then focuses on competence and confidence in skills used by paramedics, specifically exploring teaching and maintenance.

Perception of performance and actual performance is examined with particular focus given to the potential for a mismatch of these two factors and subsequent issues that may exist within practice are explored. The discussion in relation to competence, confidence, perception and the literature will lead to comment on future education, policy and direction of practice/development for paramedic skills.

In addition to the above, discussion around this area of paramedicine can be seen in appendices 17 & 18, a publication by the author based on phase one (Henderson, Endacott, Marsden & Black, 2019) and a poster based on the early

findings of phase two, presented at the professional body, College of Paramedics, National Conference 2018.

## **6.1 What Skills do Paramedics Use?**

The review of patient clinical records during phase one identified what skills were utilised by UK paramedics, those identified covered a very wide variety, from simple to complex, uni to multi-dimensional; that is, involving various facets such as communication, reasoning or complex manoeuvres, rather than solely physical actions.

In relation to the above findings, obtaining an answer to the question of what constitutes a clinical skill can be difficult. The concept of a 'clinical skill' is diverse and considered different things, with common consensus very difficult to obtain (Michels, Evans & Blok, 2012). There are a number of key domains associated with the term 'clinical skill' (see section 2.2.1). Most of the domains are physical in nature; however, clinical reasoning and communication are also included by some authors in the 'clinical skills' literature, offering a more detailed picture (Bjørk & Kirkevold, 1999; Kneebone, Kidd, Nestel, Asvall, Paraskeva & Darzi, 2002; Michels, Evans & Blok, 2012). This approach identifies with Bloom's taxonomy (Bloom *et al.*, 1956) as highlighted in chapter one, where skill can be considered on varying levels from basic knowledge to the ability to synthesise information and evaluate performance. What is a clinical skill will be discussed in more detail in section 6.3

## **6.2 Paramedic Incident Types and Skill-set in Context**

Phase one of this study highlighted the broad, nebulous nature of incidents commonly attended by paramedics in the geographical areas studied. There

has been a well-documented, rapid development of the skill-set within paramedic practice since the professions' creation in the mid 1960s, generally this has been driven by growing demand for capacity and services from the NHS nationally and the need for new ways of working to improve service provision (AACE, 2011; CoP, 2015; NHEngland, 2013; NHEngland, 2015). The same picture is also demonstrated on a local level where demand on the local ambulance service is rising (Chalk, Black & Pitt, 2016). In addition, the paramedic profession is specialist generalist in nature (see section 1.0) (CoP, 2015; CoP, 2018a; Lovegrove & Davis, 2013), indicating that the incident types attended by paramedics are wide ranging, as demonstrated by the results from phase one of this study.

The specialist-generalist nature of paramedic practice, with the constantly developing skill-set, has seen a situation develop where the paramedic profession has continually had to learn new skills and ways of working. The advent of registration with a regulatory body in the UK added another layer of complexity to this, with the setting of various standards in order to protect the public (HCPC, 2014; HCPC, 2018c; HCPC, 2018d). This in turn created further new challenges in the context of a developing professional role and maintaining competence in order to continue practicing. The importance of this factor is demonstrated in a UK Delphi study looking for consensus on various aspects of professionalism, where consideration of the importance of regulatory body standards within various contexts was identified (Gallagher, Snook, Horsefield, Rutland, Vyvyan, Juniper & Collen, 2016).

### **6.2.1 Specialist Paramedic Practice**

The focus for both phases of this study has been standard practice of UK paramedics working for an NHS ambulance service trust; any paramedic practicing in a specialist role was excluded. Despite this exclusion criteria it must be acknowledged that the expansion of practice has long been a topic of discussion, with the accepted need for specialist clinicians working within the paramedic profession, in order to maintain a depth of knowledge within a smaller subject area, such as primary or critical care (AACE, 2011; Catterall, 2012; Peate, 2015). This dialogue has continued into more contemporary times with discourse around paramedics as Allied Health Professionals (AHPs) and the need for more diverse use of the profession to enable the NHS to provide a more responsive, better quality service (NHS England, 2017). Both specialist paramedic practice, and a more diverse practice for paramedics will inevitably continue to see the development of new, more advanced skills which will eventually become mainstream, standard practice (Brooks *et al.*, 2016; CoP, 2015).

### **6.2.2 Skills Consideration for the Phase Two Clinical Scenario**

The clinical skills used for the observed scenario in phase two can be identified with multiple others in phase one of this study; following initial identification, they were selected based on complexity and frequency (see chapter three, section 3.7.7), rather than skill type/make-up. The initial plan was that the phase two observed skills would be purely technical, allowing an uncomplicated view of performance; as will be discussed in section 6.3, this is unrealistic in relation to the literature and what constitutes a clinical skill (Bjørk & Kirkevold, 1999; Laker & Powell, 2011; Pusic *et al.*, 2012), as well as the complexity of



paramedic practice (AACCE, 2011; CoP, 2018a; Lovegrove & Davis, 2013). The rubric used to measure participant performance was, as a result of the above, not as sensitive as it could have been in relation to non-technical skills. Evaluation of non-technical skills would have offered a deeper insight into the performance of paramedics. The general notes made by the assessor during the scenario demonstrate this (as discussed in section 6.7), where often comments from participants offered insight into what they were thinking (clinical reasoning) and the need for communication with control rooms and or other crews, both non-technical skills mentioned in the literature (Benbassat *et al.*, 2005; Michels, Evans & Blok, 2012). The rubric had limited capacity to reflect this information and as a result, an opportunity to collect relevant data may have been missed. Furthermore, as discussed in section 6.7.2, where non-technical performance was measured (obtaining consent), competence issues were highlighted that indicate a shortfall in practice (Gaisford, 2017). This finding would have been missed if the sole focus had been around technical skills alone.

### **6.3 The Nature of Paramedic Skills**

Chapter one of this thesis has reviewed the development of the paramedic profession and the diverse range of skills that they can perform; in addition, phase one explored the wide of range of skills identified within UK practice, in discrete geographical areas. The varying complexity and multi-dimensional nature of paramedic practice invites further discussion about what paramedic skills are.

Many previously mentioned approaches to defining skills seem a little simplistic when taken in the context of paramedic practice, a point well demonstrated in a

review of international literature that uses the example of paramedic performed airway management. The review highlights that the technical aspects of managing a patients airway are fairly simple in comparison to the non-technical decisions about how to manage complications or failure (Shields, 2011).

A perhaps fitting, early definition can be found in the nursing literature, two decades ago. It acknowledges the intricacies of paramedic practice and terms skills as 'complex' or 'open'; complex suggesting multiple movement of limbs during performance of the skill and open meaning that the skill is carried out in unpredictable circumstances (Bjørk & Kirkevold, 1999). This approach initially feels more practical; however, it is unlikely that these two ('open' and 'complex') exist in isolation, particularly in the area of paramedicine. The work also fails to fully address the cognitive element of skill performance in clinical practice, as previously mentioned with airway management, (Shields, 2011) or the importance of communication and/or clinical reasoning (Castenelli, 2009; Kneebone et al., 2007).

Clinical skills are sometimes delineated into technical and non-technical skills. A literature review looking at international studies relating to use of non-technical skills within paramedic practice defined them as those relating to social and/or cognitive function (Shields & Flin, 2013). A similar distinction was made in a literature review discussing skills training, however, instead of technical and non-technical it used the terms hard (technical) and soft (non-technical) (Laker & Powell, 2011). This review had a more general, non-healthcare focus and lacked clear explanation of search strategy; however, given the similarities in terminology with the healthcare literature around the same subject, it does seem to be transferable. A similar explanation of skill can also be found in other literature, such as an American concept article examining 'learning' and

'forgetting' curves, which used terms such as cognitive and kinaesthetic, relating to purely cognitive skills and skills that are physical (kinaesthetic) (Pusic *et al.*, 2012).

Although the two sides of each of the technical/non-technical, hard/soft, kinaesthetic/cognitive and complex/open concepts may be discrete, there is general acceptance that they often exist together (Bjørk & Kirkevold, 1999; Laker & Powell, 2011; Pusic *et al.*, 2012). Furthermore, in the previously mentioned literature review, where the terminology technical/non-technical skills is used, it is asserted that not only do they co-exist but non-technical skills complement technical skill performance in medical practice (Shields & Flin, 2013).

Discussion in two UK studies, looking at equipment carried on ambulances and procedures performed by paramedics, used the terms 'skill' and 'procedure' interchangeably (Roberts, Allison & Porter, 2003; Roberts, Jewkes, Whalley, Hopkins & Porter, 2005). Perhaps procedure is a more effective way of defining actions within paramedicine that are both physical and have a cognitive element.

### **6.3.1 Soft Skills in Paramedicine**

Clinical reasoning and communication are both examples of 'soft' skills and exist as domains of clinical skills (Laker & Powell, 2011). Consideration of domains and differing elements of clinical skills can be difficult due to their abstract nature; however, including them does acknowledge that a skill is rarely one isolated physical action or process, the complexities of clinical skills mean they are not accurately considered within terms such as psychomotor or technical, they are more than this.

Both of these 'soft' skills were included in the observed scenario for Phase two: clinical reasoning with the recognition for various interventions, and communication in history taking and gaining of consent. Communication was generally good with the patient; however, many participants sought only partial consent, often missing explanation of risks and/or an opportunity for the (simulated) patient to ask questions. A literature review exploring paramedicine and UK law highlighted that clear communication with the patient/family/carers is required when gaining consent (Gaisford, 2017; HCPC, 2014), this will be expanded on in section 6.7.1.

### **6.3.2 Communication**

Communication is long accepted as a vital aspect of effective healthcare (Kneebone, Nestel, Vincent & Darzi, 2007; Trust, 2013), and has been shown to cause errors and systems failures when it breaks down (Coiera, Jayasuriya, Hardy, Bannan & Thorpe, 2002). Literature suggests that communications training should take place in all Emergency Departments due to the perceived gravity of its importance (Coiera *et al.*, 2002), although not specific to paramedics working in ambulance services, this is obviously comparable in relation to patient-clinician communication. In an editorial piece there is further assertion that it should be an integral part of clinical skills education for healthcare workers, as opposed to the tradition of being taught separately (Kidd, Patel, Peile & Carter, 2005). Various studies have asserted the need for paramedics to have good interpersonal communication skills to support the effective management of patients (Ross, Boyle, Williams, Fielder & Veenstra, 2014; Tavares & Mausz, 2015)

### **6.3.3 Clinical Reasoning**

Clinical reasoning is a broad term used to describe the metacognitive process behind decision making and clinical judgement (Eva, 2005; Simmons, 2010).

This is a key skill for any clinician when assessing and managing a patient, such as in the phase two scenario. The scenario management requirements were largely straightforward however, there were some complex elements, such as a patient in cardiac arrest with a failing airway and single rescuer on scene with no bystander support. This situation required participants to decide whether to manage the airway or concentrate on good quality chest compressions.

Recent evidence has emphasised the importance of chest compressions for the patient in cardiac arrest. An American five year prospective study looking at layperson compression only resuscitation found that it was more effective than conventional cardiopulmonary resuscitation (CPR) (Bobrow, Spaite, Berg, Stolz, Sanders, Kern, Vadeboncoeur, Clark, Gallagher & Stapczynski, 2010), albeit in the context of non-healthcare personnel. This seems to potentially de-emphasise the need for airway intervention by the participants in phase two of this study; however, the cited research focussed on non-healthcare professionals that don't have a responsibility to provide care. A subsequent American literature review looked at management of cardiac arrest from a healthcare professional perspective, it emphasised the importance of establishing uninterrupted chest compressions but also that in cardiac arrest of non-asphyxial, non-haemorrhagic origin, quality cardiac compressions and early defibrillation were the two most important priorities (Cunningham, Mattu, O'Connor & Brady, 2012).

UK practice and guidelines still support the use of CPR over only cardiac compressions by healthcare professionals (Soar *et al.*, 2015); physiology dictates that eventually inadequate or absent ventilation will mean that even good quality chest compressions will become less effective due to hypoxaemia. Participants in phase two appeared to struggle with the decision to interrupt chest compressions in order to manage the failing airway; however, eventually the majority of them concluded that they would have to take time to do so for the longer term gain. The difficulty of this decision was compounded by being a single responder with no bystander assistance. This meant that during the scenario, management of the airway was delayed and in some circumstances was disjointed as the participants tried to complete the tasks in short, frequent steps rather than in actions concluding with each escalation of the airway. The situation with clinical reasoning was explored in an Australian review of the literature, based on clinical skill teaching where an assertion is made that soft skills are what separate the expert from the novice. Their assertion being that generally the novice will often concentrate on psycho-motor aspects of skills (Castenelli, 2009). Despite the difficulty some participants experienced in making their decisions, failure to recognise the need for intervention was not observed during the scenario, indicating sound insight with this intervention at the very least.

#### **6.4 Factors Affecting Performance**

Paramedic participants in this study potentially completed four different clinical procedures during the scenario, complex/frequent, complex/infrequent, simple/frequent and simple/infrequent. Review of the free-written data from phase two showed four key themes related to factors affecting the confidence

and competence of paramedics in their practice; these included aspects such as education, personal, experience and environment. Certain patterns were noticed in relation to perception of performance and actual performance.

#### **6.4.1 Actual and Perceived Performance**

Psychological literature has long explored the relationship between performance and self-perception of performance (Juslin, Winman & Olsson, 2000). In a meta-analysis of studies looking at student/teacher rating comparisons, the assertion that performance and perception of performance by individuals often only correlate modestly was made (Falchikov & Boud, 1989). This phenomenon was demonstrated with the simple/frequent skill of oxygen administration during the observed scenario. Paramedic participants rated their confidence and competence highest during self-rating; however, the scenario performance scores were the lowest of all four skills.

In 1999 two American authors posed and tested a hypothesis expanding on that of Falchikov & Boud (Kruger & Dunning, 1999). In a series of experimental studies using American undergraduate psychology students; grammar, logic and humour appreciation were all evaluated. The authors demonstrated that participants scoring in the lowest quartile of this assessment/test often perceived that their score was much better, sometimes in the highest quartile; furthermore, they failed to recognise their shortcomings even when they had opportunity to compare themselves with their more successful peers. They concluded that 'unskilled' people often hold over favourable views of their own ability, demonstrating the 'better than average' effect (Krueger & Mueller, 2002); that is, the average person believes that they are above average in their performance.

A more medical, emergency care focus with a similar concept was offered in a letter to a UK medical journal, where the authors explored clinical development through a long established learning model 'the conscious competence' matrix, originally posed by Robert Dubin (Higginson & Hicks, 2006); this suggests four stages;

1. Unconscious incompetence
2. Conscious incompetence
3. Conscious competence
4. Unconscious competence

The authors of the letter pose that they have identified an additional stage in relation to doctors new to working in the Emergency Department, they suggest that there is an initial consciously incompetent stage before progressing to unconscious incompetence (Higginson & Hicks, 2006). This study did not fully support the findings of Dunning & Kruger, this may be explained by the proposition made by Higginson & Hicks that new healthcare professionals are initially aware of their incompetence (Higginson & Hicks, 2006), as almost half of the participants in phase two of this study had been in clinical practice for a year or less.

Dunning and Kruger also suggested that the inexperienced/uneducated, who believe they are better than average, lack the metacognitive ability, or insight to recognise this issue (Dunning *et al.*, 2003; Krueger & Mueller, 2002; Kruger & Dunning, 1999; Kruger & Dunning, 2002). This phenomenon is termed the 'double curse' by Dunning and Kruger within their work on performance. They suggest that the same cause of poor performance subsequently prevents people from recognising it, due to a lack of metacognitive ability (Dunning *et al.*, 2003; Kruger & Dunning, 1999).



Generally, as previously mentioned, skills assessed within the scenario did not support the findings of Dunning & Kruger. Self-perception, both pre and post scenario were largely well aligned to actual performance. However, there were two skills of interest (intermediate airway management and oxygen administration), both of which showed significant changes in self-rating scores between pre and post scenario questionnaires. Confidence and competence self-rating rose in intermediate/advanced airway management and oxygen administration fell following the scenario. In relation to performance, participants scored highly with intermediate/advanced airway management and poorly with oxygen administration. These findings served to demonstrate the development of good insight into performance. It is difficult to say exactly why this initial (pre-scenario) limited insight was found, but perhaps it is linked to an expectation that intermediate/advanced airway management would be difficult but was actually a well-practiced procedure, whereas oxygen administration seems very simple but aspects such as consent and explanation were not always given due consideration, this will be discussed in section 6.7.1 - Consent.

Direct comparison of Dunning and Kruger's results with that obtained from paramedic participants from this study is perhaps difficult, not least, due to the question of transferability between undergraduate psychology students in the US and registered, practicing paramedics from the UK. This said, since 1999, Dunning and Kruger's study has been used as a model and has found similar results within healthcare related areas, although not paramedicine (Haun, Zeringue, Leach & Foley, 2000; Hodges, Regehr & Martin, 2001).

Discussion around confidence can lead to the 'hard-easy' effect, which suggests that overconfidence is most severe with complex theory/skills (Juslin,

Winman & Olsson, 2000). Participants in phase two of this research did not demonstrate this fully: they rated the highest confidence with one complex skill (IV cannulation) and one simple skill (oxygen administration). In relation to self-perception, Juslin et al further suggest that people are more accurate in self-perception if it involves situations where they have prior experience/knowledge (Juslin, Winman & Olsson, 2000); this obviously does not explain the lack of insight in relation to oxygen administration, which is a frequently practised skill. In the context of the other skills it does demonstrate links to the technical aspects of intravenous cannulation which is both complex and practised regularly.

#### **6.4.2 High Performance**

The discussion around Dunning and Kruger's work has so far focussed on low performance; however, albeit to a lesser extent, they suggest that the highest performers tend to underestimate their ability, performing better than they perceived. Phase two results did support this, where participants gave their second lowest perceived competence scores for basic airway maintenance but scored highest for this skill during the observed scenario. Similarly, the lowest perceived scores were recorded for intermediate airway management, which had the second highest scores. The source of the error in perception and performance is thought to be different for 'top performers', with the suggestion that they overestimate how well others have done, therefore feeling like they won't be as good and they subsequently reflect this in their perception (Dunning *et al.*, 2003).

### 6.4.3 Improving Perception

The Kruger & Dunning study in 1999 established the rather intuitive point that improving knowledge/competence through education would improve insight of the 'unskilled' in relation to their ability (Dunning *et al.*, 2003; Kruger & Dunning, 1999). It was further suggested that following feedback, the 'inexperienced'/'uneducated' were still unable to identify issues within their performance (Dunning *et al.*, 2003; Kruger & Dunning, 1999), the post scenario, self-reported competence/confidence scores for oxygen were still highest overall, to some extent confirming this.

During the scenario, no feedback was offered to participants; however, it would be reasonable to expect that they would think about their own performance as they managed the patient. This process was termed reflection-in-action by Schon and simply describes the process of reflection on what you are doing, as you do it (Schön, 2017). It was noted during the phase two clinical scenarios that many participants gave a commentary; this commentary was often about what they were doing and why they were taking that course of action.

Not all candidates provided such a commentary, displaying reflection-in-action as they worked through the scenario; however, after completing a skill, it may be reasonable to think that participants would be able to evaluate their performance. Some participants recorded on the post-scenario questionnaire that they had scored themselves 'low' for competence due to problems with their performance, indicating that they had insight into issues with their performance.

The above-mentioned 'Dunning Kruger' effect was explored in a replication study by Krueger and Muller. The authors proposed that the results were explained by the regression effect and 'better than average' (BTA) phenomena,

they suggested that the metacognition theory was not required to explain Dunning and Kruger's initial results. Regression effect suggests that an initial extreme measurement will be closer to the mean if measured a second time. The BTA phenomena rather simply proposes that people generally believe that they are better than average, this will of course be true for some; in addition, it must be highlighted that the BTA effect is less significant when considering more complex skills (Krueger & Mueller, 2002). This perhaps demonstrates the more accurate perception of participants with the more complex skills, such as IV cannulation and intermediate/advanced airway management. It is therefore reasonable to propose that if these authors are correct conducting the study again could offer more accurate results. Alternatively, authors of a paper exploring the 'hard-easy' effect suggest that people overestimate their performance with complex tasks and underestimated with simple tasks (Moore & Healy, 2008), this concept was not demonstrated by participants in this study. Krueger and Muller's paper did agree that making poor performers more competent will improve their insight, and performance, a somewhat paradoxical situation. Dunning and Kruger provided a response to this criticism in the same year (2002) where they concluded that the regression effect may account for some error but cannot be apportioned to the entire picture (Kruger & Dunning, 2002). More recently a paper discussed potential issues with sample selection suggesting Dunning and Kruger had used a convenience sample, which affected their results, the authors suggested that the use by Dunning and Kruger of students from a high performing university created the asymmetric 'J' shaped (truncated from below) distribution (Krajc & Ortmann, 2008). Furthermore, the same authors suggested that the use of young, inexperienced students created a difficulty for them to identify issues, what they termed signal

extraction and inference difficulties (Krajc & Ortmann, 2008); this inference/signal extraction issue is subtly different to the lack of metacognitive ability discussed by Dunning Kruger, it is more aligned to a perceptual issue, it is suggested it can be relatively easily rectified through basic intervention and feedback (Krajc & Ortmann, 2008). This might include feedback on performance position within a group for example.

## **6.5 Skill Performance in Practice**

Results from phase one of this study demonstrate the stark infrequency of some skills, such as airway maintenance, including both basic and advanced methods. This stands to reiterate the rarity of this skill, as mentioned in the literature (Deakin, King & Thompson, 2009). It should be remembered perhaps, that the implied patient safety of more basic management techniques does not necessarily overcome the infrequency of practice. Familiarity and initial 'encoding' of a skill are important factors and are often mentioned in the context of forgetting curves. These curves suggest that after initial learning and rapid improvement in competence, there will be rapid degradation in performance of a skill that is not frequently practiced. It is suggested that competence will ultimately be maintained at a basic level (Pusic *et al.*, 2012).

### **6.5.1 Airway Management**

Infrequent practise of airway management by paramedics in the UK was highlighted in a retrospective review of clinical records completed by clinicians working in a UK ambulance service (Deakin, King & Thompson, 2009). It found that almost 50% of paramedics did not carry out advanced airway management (endotracheal intubation) during a twelve-month period. The similarity of

aspects of this study, in relation to the author's own work suggests generalisability of the results within the UK for intermediate/advanced airway intervention by paramedics.

A qualitative study, conducted in the same ambulance trust area, interviewed ambulance staff of various clinical grades to elicit their opinions and feelings about training and education, within the context of developing roles and skills. Concern from clinicians regarding 'de-skilling' in skills infrequently practised (such as those above) was highlighted, as well as concern over the best way to train/educate clinicians for the future (Cooper, 2005). This study provides a relevant insight into how clinicians within the same Trust feel about the developing role; however, participants were various clinical grades, both junior and senior to the traditional paramedic role so caution should be exercised in the specific findings. Future research into the effects on specific clinical grades would be helpful to overcome this, offering greater specificity.

### **6.5.2 Absence of Manual Airway Manoeuvre**

Further to the striking findings in relation to the intermediate/advanced airway maintenance methods, review of PCRs during phase one did not show any record at all for the use of manual airway maintenance (see section 2.4), the most basic of methods. This seems a strange finding in a Trust where a 'stepwise' approach to airway management is advocated, suggesting that to arrive at intermediate/advanced methods, basic methods should likely first be attempted.

An alternative view is evident in the results from phase two of this study, where participants sometimes opted to not use basic airway adjuncts, verbalising that this was so they could progress to a more advanced method of airway

management more quickly. Although this provides a potentially viable explanation for the absence of basic airway adjunct use, it does not explain why manual airway manoeuvres would be missed, especially given that they would be required to open the airway initially to check the ventilatory status of a patient.

### **6.5.3 Endotracheal Tubes versus Supraglottic Airway Devices**

During Phase two of this study, most participants managed the airway effectively using a supraglottic airway, or opted not to perform endotracheal intubation during the scenario. This reflects local working practices already described where a step-wise approach is advocated but also a wider picture where the use of endotracheal intubation has been de-emphasised in recent years (Benger, Kirby, Black, Brett, Clout, Lazaroo, Nolan, Reeves, Robinson & Scott, 2018). Recently 'Airways-2', a UK multi-centre, cluster RCT enrolling 9296 patients explored whether there was clinical benefit in the use of tracheal intubation versus use of a supraglottic airway device, both of which are infrequent paramedic skills, as already discussed. The study concluded that there was no benefit for patients who received advanced airway management in comparison to the intermediate methods such as supraglottic airway devices (Benger *et al.*, 2018; Taylor, Black, Brett, Kirby, Nolan, Reeves, Robinson, Rogers, Scott & South, 2016). Prior to the 'Airways-2' trial, Deakin, King and Thompson suggested that training for advanced airway management was not sufficient and below the level required for doctors in hospital (Deakin, King & Thompson, 2009). An American review article looking at airway management evidence also highlighted the complex and difficult nature of endotracheal intubation, exploring alternative strategies for the prehospital environment and

suggesting supraglottic airway devices as an alternative, concluding that they are a more simple and safe option (Dupanovic, Fox & Kovac, 2010). Further, a German prospective study looked at the effectiveness of supraglottic airway devices prehospitally through the completion of questionnaires following airway intervention, it concluded that such devices were effective and safe due to their ease of use (Schalk, Byhahn, Fausel, Egner, Oberndörfer, Walcher & Latasch, 2010). Although logical in their conclusions, the non-UK specificity of these papers limits any generalisability with large variations in practice/training internationally. In addition, the study by Schalk et al, studied doctors as well as paramedics, in a healthcare system that is very different to the UK, using different supraglottic airway devices (Schalk *et al.*, 2010).

## **6.6 Stress, Anxiety and Working Memory Performance**

Although not captured specifically, it was the author's perception that some participants appeared to find the phase two scenario progression stressful and anxiety inducing. There is significant overlap between anxiety and stress, anxiety is heightened vigilance, with limited control over worrying thoughts giving greater attention to the negative (Lukasik, Waris, Soveri, Lehtonen & Laine, 2019). Stress on the other hand can be a positive factor, depending on the level to which exists (Lukasik *et al.*, 2019; Yerkes & Dodson, 1908).

Despite the generally good performance of most participants, some made questionable decisions at various points during the observed scenarios.

Anxiety is associated with a reduction in working memory (WM) performance, i.e. the ability to make decisions and reason. This was established in a study of American adults who completed questionnaires and WM tasks (Lukasik *et al.*, 2019). The same authors identified that stress did not have the same negative



effect on WM. An earlier review of the literature in relation to WM and anxiety had a similar finding, that anxiety is linked to poorer performance (Moran, 2016). This would give weight to this assertion that under the pressure of the scenario, some participants struggled to always make sound decisions, a skill vitally important to paramedic practice. The assertion of this reduced performance with anxiety will be further noted in this chapter, in the context of decisions made by participants during high demand points in the observed scenario, where their actions were questionable in their management of a failing airway in conjunction with ensuring early defibrillation and effective, timely compressions.

#### **6.6.1 Context/Environment and the Yerkes-Dodson Law**

The previous discussion suggested that stress was not negatively related to performance (Lukasik *et al.*, 2019; Moran, 2016). This has long been the subject of investigation linking the two. Perhaps the earliest example of this originated from animal studies carried out on mice, by two American psychologists (Yerkes & Dodson, 1908), which resulted in what was termed the Yerkes-Dodson Law. This suggests that, as arousal (stress) increases so does performance; however, at a given point of arousal, performance begins to decrease. This pattern may explain the suggestion that there is no negative impact on performance because at specific levels, where stress is not too great and not too little, there is no marked effect. This study is obviously dated, although seminal in its findings; in addition, there are obvious issues with transferability of findings from an animal study when considering performance of people in a specific role.

A contemporary American review paper looking at performance in emergency care highlights effects that are similar to the Yerkes-Dodson Law, saying that excess stress can be detrimental to performance, citing two more recent theories that support this. The first is the 'appraisal mechanism' and the second the 'compensation' model. The 'appraisal mechanism' describes how an individual's response to a situation will be influenced by their own appraisal of it. The second, 'compensation' refers to behaviours that are adopted by a person to cope with a given situation (Lauria, Gallo, Rush, Brooks, Spiegel & Weingart, 2017). This paper is not of UK or prehospital origin, however the emergency care/time sensitive environment of some incidents can be transferred and although the prehospital environment may increase stress (due to the lack of control) it is still felt to be comparable by the author.

An earlier literature review by a similar research group, published in an Australian journal also highlighted the benefits on performance of using psychological skills training to overcome excess stress/anxiety and improve performance (Lauria, Rush, Weingart, Brooks & Gallo, 2016). Further, a review of the literature in relation to the performance of medics in acute care highlighted the benefit of stress inoculation training; this process involves exposing clinicians to small amounts of stress, which builds their confidence and enables performance for a time when they are put under more stress in practice (LeBlanc, 2009).

The fluid, 'chaotic' nature of paramedic practice was highlighted in a paper discussing theories-of-practice (Campeau, 2015). This working environment can apply further pressure to the practice of clinical skills performed by paramedics, with the assertion that having to improvise during practise will potentially impact on accuracy (Bjørk & Kirkevold, 1999). It is possible to

hypothesise that this challenging work environment perhaps acts as some sort of stress inoculation training, providing that levels of stress are not too high. The above discussion around stress/performance and the paramedic role can be related to the free-written data from phase two, where 'Environment/Scene' and 'Personal' were both themes within the four most frequent when participants were self-rating confidence and competence.

## **6.7 Deviation from Guidelines and Evidence Based Practice**

During the scenario aspect of phase two, various commonly occurring deviations from standard procedure were identified, such as releasing the tourniquet at the incorrect point during intravenous cannulation, incomplete verification sequence for placement of a supraglottic airway, inadequate chest compressions and incomplete consent, as previously discussed.

An American observational study looking at experience and performance in simulated clinical scenarios found that anaesthetists of varying experience made errors in managing critical incidents, however, the experienced clinicians identified the issues and corrected them more swiftly (DeAnda & Gaba, 1991). This study is not UK based and is now dated; however, the concept is still relevant as there are obvious similarities between the clinical area of practice and phase two of this study, maybe this suggests that more experience and exposure to stressful situations enables clinicians to be cognisant of their performance.

The study mentioned above discusses management of 'unplanned incidents' (or errors) by its participants; it proposes that the experienced clinicians are more able to develop alternative plans to rectify issues quicker than their inexperienced colleagues (DeAnda & Gaba, 1991). An Australian

ethnographic study looking at paramedics practising in Australia extended this view a little suggesting that experience is a factor in clinical decision making; however, other considerations come into play, such as the presence of guidelines and the ability to revert to basics (Wyatt, 2003).

Similar to the discussion around deviation from standard procedure, during the observed scenario, note was made with some candidates in relation to a delay in defibrillation/compressions as well as sub-optimal chest compressions.

These observations often seemed to be connected to high demand points during the scenario, for example immediately following the cardiac arrest when decisions around managing a failing airway had to be made in conjunction with ensuring early defibrillation and effective, timely compressions. The ability to make effective decisions in these situations is often connected to knowing and understanding current evidence (Carley, 2007). A systematic review of allied health professionals, exploring determinants for evidence use in practice highlights a lack of its use, sometimes known as the 'research-practice gap' (Lizarondo, Grimmer-Somers & Kumar, 2011). A Taiwanese questionnaire surveyed EBP use, implementation and understanding of evidence based practice (EBP) amongst healthcare professionals. It found that almost three quarters of healthcare professionals believed in EBP; however, less than half had implemented it in their practice; furthermore, it found that EBP was more likely used by clinicians with higher education (Weng, Kuo, Yang, Lo, Chen & Chiu, 2013).

The results from phase two of the study did not show any significant variations in performance with age or time practicing as a paramedic. Standards and procedures within healthcare are not always evidence based and these uncertainties may explain that some clinicians were willing to deviate from the

rubric used to score the scenario. A previously mentioned Australian ethnographic study considering decision making, identified that more experienced paramedics were more willing to deviate from guidelines (Wyatt, 2003), the results in phase two of this study did not support this with any significance. However, closer examination of the results from the scenario showed that participants of phase two that are Practice Educators scored significantly lower than the non-Practice Educators on intermediate airway management. Practice educators tend to be more experienced members of staff and therefore this finding may be explained by a willingness to deviate from guidelines by experienced members of staff, as mentioned above (Wyatt, 2003). Benner's work on the journey from 'novice' to 'expert' highlighted that 'experts' will sometimes deviate from guidelines and cut corners; furthermore, this work highlighted that they were often unable to provide a rationale for decisions or practice, often qualifying it as 'something they just felt or did' (Benner, 1982).

#### **6.7.1 Deviation from Guidelines Involving Soft or Hard Skills**

During the observed scenario from phase two of this study, as mentioned in the previous section, note was made that candidates sometimes deviated from guidelines; within this, there were two common trends identified;

- Incomplete consent prior to oxygen administration and intravenous cannulation.
- Elements of procedural skills missed or completed out of sequence such as tourniquet release and airway placement verification.

### **6.7.2 Consent**

In phase two of this study during the observed clinical scenario, participants should have sought consent for both oxygen administration and intravenous cannulation. The results showed that this was not always done completely, with these elements of the scores being low in both skills. The seeking of consent for intravenous cannulation scored slightly higher than for oxygen administration. This may be because IV cannulation is a more invasive skill and was therefore considered more serious by the participants.

An Australian review, including case studies, acknowledges the difficulty faced by those working in emergency care when seeking consent, it listed various reasons for this such as time pressure, emotion, information deprivation, conflict, stress and fatigue (Steer, 2007). This article highlighted the difficulties in trying to address consent when in an uncontrolled, dynamic environment. Obviously a non UK study may indicate differences in the process/prospect of obtaining consent, in both legal and cultural approaches; however, the nature of the paramedic role is obviously similar and therefore it seems reasonable to presume that practices/issues would therefore be comparable.

A questionnaire study, also carried out in 2007, in the UK examined the knowledge of doctors, nurses and ambulance staff around consent and capacity. The researchers concluded that knowledge in this area from all these professional groups was lacking; in some questions ambulance staff failed to record any correct answers (Evans, Walker & Jackson, 2007). Although this study is UK based, it is now over ten years old and undertaken prior to the introduction of widespread higher education for the paramedic profession. Degree programmes are rightly expected to include consent and capacity in their curricula. In addition, this study had a relatively small number of

participants raising doubt over its power. In 2009 a review of literature and the law in relation to consent, highlighted the importance of consent for UK paramedics, it cited the importance of consent being full (explaining everything that will be done), free (no undue pressure applied to the patient) and informed (the patient must be given enough information to make a choice) (Griffith, 2009). The focus of the review was achieving 'valid' consent and the author acknowledged that the patient needs 'sufficient' information based on the intervention that is to be undertaken (Griffith, 2009).

A subsequent, more contemporary review explored the concept of consent; it did this in the context of recent case law, giving greater focus to informing the patient of risks that are so significant they should be mentioned (2018). The article acknowledges the difficulty in doing this and the subjectivity that exists when considering such detail (Gaisford, 2017). Similar discussion is offered in an opinion piece that highlights the 'death' of medical paternalism, with a move to generating more patient autonomy (Chan, Tulloch, Cooper, Smith, Wojcik & Norman, 2017).

### **6.7.3 Consent for Oxygen Administration/Intravenous Cannulation**

During the observed clinical scenario consent for administration of oxygen and intravenous cannulation was often incomplete, and in some cases absent; the simulated patient was often asked by the participant if they could cannulate them but rarely given pertinent risks/benefits and even more rarely give the opportunity to ask questions about the procedure.

Sometimes in the emergent situation clinicians may make decisions in the patient's best interest; however, this is more often done where the patient lacks capacity (Gaisford, 2017; Griffith, 2009). The skills mentioned above (oxygen

administration and IV cannulation) were performed at a point in the scenario where the patient had clear capacity to make decisions about their own care suggesting this was not a 'best interest' decision by paramedic participants. Autonomy is a key part of ethical consideration for healthcare professionals, this relates to the right of people to make informed decisions about their own treatment (Beauchamp & Childress, 2001; Sjostrand, Ericsson, Juth & Helgesson, 2013). An article written by Swedish authors exploring biomedical ethics suggests that there is sometimes justification in the use of paternalism in order to allow autonomy, it suggests that sometimes a course of action needs to be taken to prevent the patient making an un-informed decision (Sjostrand *et al.*, 2013), such as a clinician stopping the patient from taking a medication if they are un-aware of an allergy they may have to an ingredient. In the context of the phase two scenario, again this was not the case, it would be difficult to argue that consent was incomplete in order to allow the patient greater autonomy at a later point.

#### **6.7.4 Technical Elements of Procedural Skills**

During phase two of the scenario some elements of skills would be completed out of sequence. Specifically, this commonly involved intravenous cannulation, where the tourniquet was released prior to removal of the cannula stylet. If done during cannulation of a real patient then this would mean the stylet was removed whilst there was still increased pressure in the vein, thus risking unnecessary haemorrhage, although unlikely life threatening this would damage patient confidence in the clinician and arguably go against the bioethical principle of non-maleficence, doing no harm to your patient (Beauchamp & Childress, 2001).



This finding presents a confusing situation, there does not seem to be an obvious reason for completing the task in this order, it does not offer a time or a clinical benefit; in addition, it was an error that appeared to be made by participants with varying educational backgrounds and experience. It was felt by the author that it demonstrated a lack of deep understanding; the order in which these elements are completed is dictated by simple working mechanical knowledge of what each step does on an anatomical level. The more surface learning approach taken by non-graduate paramedics (reported in the literature) would perhaps explain this observation (AACE, 2011; Bradley, 2005; Cooper, 2005; Lovegrove & Davis, 2013; Ryan & Halliwell, 2012); however, more than half of the participants in phase two were graduates for whom it is generally accepted that there is a deeper learning approach (Cooper, 2005; Ryan & Halliwell, 2012).

During airway management there were also elements of the procedure that were commonly missed such as lack of auscultation and lack of tying the SGA device in place. The design of the scenario rubric meant that justification for this was often explored with the candidate in the scenario debrief. Conversely to the situation with intravenous cannulation, generally candidates sited speed of practice as the reason for missing auscultation, something which the author felt was clinically justifiable due to the anatomical positioning of the airway (supraglottic), making unilateral placement highly unlikely. In relation to not tying the device in, they again, often demonstrated deeper knowledge and the ability to cite evidence in relation to reducing interruption to chest compressions (Soar *et al.*, 2015).

## **6.8 Validity of Simulation**

The author of this thesis aimed to ensure that the clinical scenario encountered by participants was realistic, both in terms of embedded skills and scenario progression and also types of incident attended; this led to the development of a scenario for a chest pain patient (cardiac origin), the decision for this was informed by phase one of the study, where this was the third most common provisional diagnosis code identified.

Simulation when planned and executed carefully has been found to be realistic; however, ultimately it is not real life and as such can induce tensions or conversely, a cavalier attitude (Chopra, Gesink, DE JONG, Bovill, Spierdijk & Brand, 1994). Some of the previously mentioned clinical practices such as late release of the tourniquet and incomplete securing of a supraglottic airway may be explained by the 'cavalier attitude'. It was the author's impression that the majority of participants were notably anxious about participating in the scenario, many verbalising this; specifically, graduates commented on this feeling like an objective structured clinical examination (OSCE), this was despite reassurance from the author that it was not. Anecdotally, more experienced paramedics were far less nervous and more relaxed; these observations led the author to hypothesise that perhaps tension is experienced by the less experienced paramedics and a cavalier attitude by those with more experience in the simulated environment.

An American study looking at the use of a clinical simulation to assess the competence of student nurse anaesthetists and junior resident doctors in acute care scenarios concluded that simulation is a reliable method of testing and maintaining clinical competence (Murray, Boulet, Kras, McAllister & Cox, 2005).

An earlier UK randomised control trial evaluating simulation looked at the

performance of Anaesthetists and trainee Anaesthetists, it highlighted that clinical simulation was a valuable way of maintaining competency for situations not routinely encountered (Chopra *et al.*, 1994). These articles suggest that the use of this clinical scenario was a valid tool for examining competence and confidence, despite the potential issues already mentioned in relation to tension and cavalier attitudes.

A largely descriptive paper from a conference presentation, reviews the competence paradigm, it highlights that performance in a single scenario/assessment cannot be used to reflect general competence (Miller, 1990), despite the potential issues with quality, similar assertions are made in a review article published eleven years later (Wass, Van der Vleuten, Shatzer & Jones, 2001). Both the aforementioned papers discussed 'Miller's pyramid of competence', this model relates to validity and proposes that there are four levels of competence starting at 'knows', 'knows how', 'shows how' and 'does'. The use of OSCEs or practical assessment scenarios falls in to the 'shows how' section of the pyramid. This in addition to Chopra *et al.*'s work, reflects that use of a clinical scenario, as in phase two of this study is a valid tool and should effectively enable the demonstration of competence (Wass *et al.*, 2001), although it is recognised that the performance of participants in a one-off scenario is not necessarily reflective of their general practice (Miller, 1990). In relation to this model, the most valid way to evaluate competence/confidence would be observation/assessment in real-life practice, this presents an opportunity for future research but would need to be carefully considered in order to capture the desired data in an unpredictable setting.

## **6.9 Learning Skills**

Discussion around education in skills initially leads back to the 'type of skill' debate. The previously mentioned American literature review by Laker and Powell raised the question of 'training transfer'; a concept defined as, how what is learnt is subsequently applied in practice for the benefit of performance. It asserts that the literature shows a distinction between hard and soft skills, and that soft skills are less easily transferred into practice (Laker & Powell, 2011). This might be demonstrated by the issues already highlighted in the phase two scenario with gaining consent prior to oxygen administration and IV cannulation, especially given that despite this, technical aspects of the skill were generally completed competently.

### **6.9.1 Deliberate Practice**

The value of teaching soft skills such as communication alongside technical skills is intuitive and was highlighted by a qualitative UK based study exploring integrated skills (communication and technical) teaching with medical students (Kneebone *et al.*, 2007). This same study emphasised the importance of deliberate practice. Fourteen years earlier, Ericsson and colleagues had discussed the importance of deliberate practise where they emphasised the need for focussed time, engaging in learning skills, promoting specially designed activities, with feedback, over prolonged periods. They suggested that it took ten years of such practice to achieve expert performance (Ericsson, Krampe & Tesch-Romer, 1993). This same concept suggests initial performance improves rapidly to a certain level but then plateaus; it is at this point where deliberate practice can be best used to significantly improve performance (Castenelli, 2009; Ericsson, 2008; Ericsson, Krampe & Tesch-

Romer, 1993; Ericsson, 2004). Association of this concept could be made with the number of years practicing as a paramedic, the suggestion being that those in the role for longer would perform better; however, the results from phase two did not support this, perhaps because every day paramedic practice doesn't necessarily meet the requirements of deliberate practice, such as specially designed activity, with feedback. It more supports that generally paramedics development will stall and plateau at a given level rather than continue on to the deliberate practice described by Ericson (Ericsson, 2008).

Ericsson and colleagues have specifically related the concept of deliberate practice to medicine, again emphasising the importance of focussed 'deliberate' practise in order to reach expert ability (Ericsson, 2008; Ericsson, 2004).

Previous discussion within this chapter has eluded to not only the technical ability but also communication and clinical reasoning skills (Laker & Powell, 2011; Shields & Flin, 2013). The advent of a higher education route to paramedic registration saw a deeper learning strategy that allowed for this deliberate practice, when compared to the previous shorter time-constrained training courses attended by ambulance clinicians, that had focussed more on technical skills (Cooper, 2005; Ryan & Halliwell, 2012). Most participants in phase two of this study were university graduates so had likely benefitted from a deeper learning, deliberate practice type approach that included communication and decision making; however, this was again not supported by the results of phase two of the study when looking at year practicing and scenario performance scores.

### **6.9.2 Distributed and Massed Practice**

The current largely graduate route to paramedic practice utilises a learning model spread over a three year undergraduate course, which will revisit certain themes/skills, with increasing complexity as students' progress. This has become known as a spiral curriculum and is advocated by the professional body, the College of Paramedics in their undergraduate curriculum guidance (CoP, 2019).

Exploration of learning theory in relation to skills talks about 'distributed' and 'massed' practice. As suggested by the names, 'massed' practice implies less frequent, longer periods of learning, whereas 'distributed' practice implies shorter, more regular periods of learning, more aligned with the deliberate practice model already discussed. It is thought that distributed practice is affected less by a phenomena known as reactive impedance, a discrepancy between learning and performance, thought to be caused by psychological or physical fatigue (Mackay, Morgan, Datta, Chang & Darzi, 2002). As a result, it shows more efficient learning and better maintenance of skill (Baddeley, Eysenck & Anderson, 2009; Mackay *et al.*, 2002). This concept was explored in a randomised control trial looking at how distributed and massed practice impacted on the learning of novice doctors, with a procedural skill, surgical endoscopy (Mackay *et al.*, 2002). The article concluded that participants from the 'distributed practice' group performed significantly better than those from the massed practice group. These findings, although not specific to paramedicine, are from the UK and from within healthcare, suggesting they are transferable to paramedic practice. This is backed up by the recent adoption of and emphasis placed on the spiral curriculum model by the College of Paramedics.

The concepts of both deliberate practice and distributed practice feed into the encoding of a skill. Encoding allows the perceived item of interest to be converted into a construct that can be stored within the brain, and then recalled later from short-term or long-term memory. Pusic et al in their concept article discussing experience curves suggest that the strength of encoding will impact on the rate of degradation if the skill is not practiced, they also highlight deliberate practice and skill complexity to have similar impact on speed of skill degradation, i.e. the more complex a skill is the faster the degradation will be (Pusic *et al.*, 2012). Similarly, as already discussed in this section, the use of distributed practice will allow for more effective encoding resulting in an improvement of long term memory (Baddeley, Eysenck & Anderson, 2009; Mackay *et al.*, 2002) and a reduction in the rate of degradation.

This process of learning skills and gaining experience aligns well to the model developed by Patricia Benner where practitioners (in this case nurses) move from novice to expert, in five distinct stages (Benner, 1982);

1. Novice
2. Advanced Beginner
3. Competent
4. Proficient
5. Expert

This model allows for levels of competence above that of a base level competence, but also movement between the different categories (Benner, 1982). Benner's model was developed using the Dreyfus, skill acquisition model (Dreyfus, 2004), it highlighted the importance of focussed learning to move through the levels as well as a combination of education with experience in practice. Initially this may feel like practising paramedics from phase two

would have advanced through the stages further than the graduates; however, recent graduates have spent three years participating in a structured programme of study linking theory to practice, with structured practice placements. Again, the key to development appears to be planned structured learning (Benner, 1982). Not only does Benner's model chart a movement between stages of development, it also highlights certain aspects of expert practice such as cutting corners in their actions and not having to adhere to guidelines; in addition, it has also been posited that experts might be unable to explain how or why they do things so well. This difficulty is thought to occur as the expert forgets the many steps they took and lessons they learned on their learning journey, much of what they now do is intuitive (Benner, 1982).

### **6.9.3 Forgetting Curves**

With the infrequency of some skills demonstrated in phase one of this study, such as airway management, and the information already discussed around deliberate practice and distributed learning, attention is brought to a concept article with a focus on emergency medicine. Pusic et al, discuss experience curves; which can be broken down into learning and forgetting curves. As suggested by the name these chart the learning of a skill until competence is achieved, if 'training' or deliberate practice is then stopped, depending on the frequency of use and initial encoding competence will reduce until competence is lacking (forgetting curve) and further training or deliberate practice would be required to achieve competence again (Pusic *et al.*, 2012), figure 6.1 shows this concept.



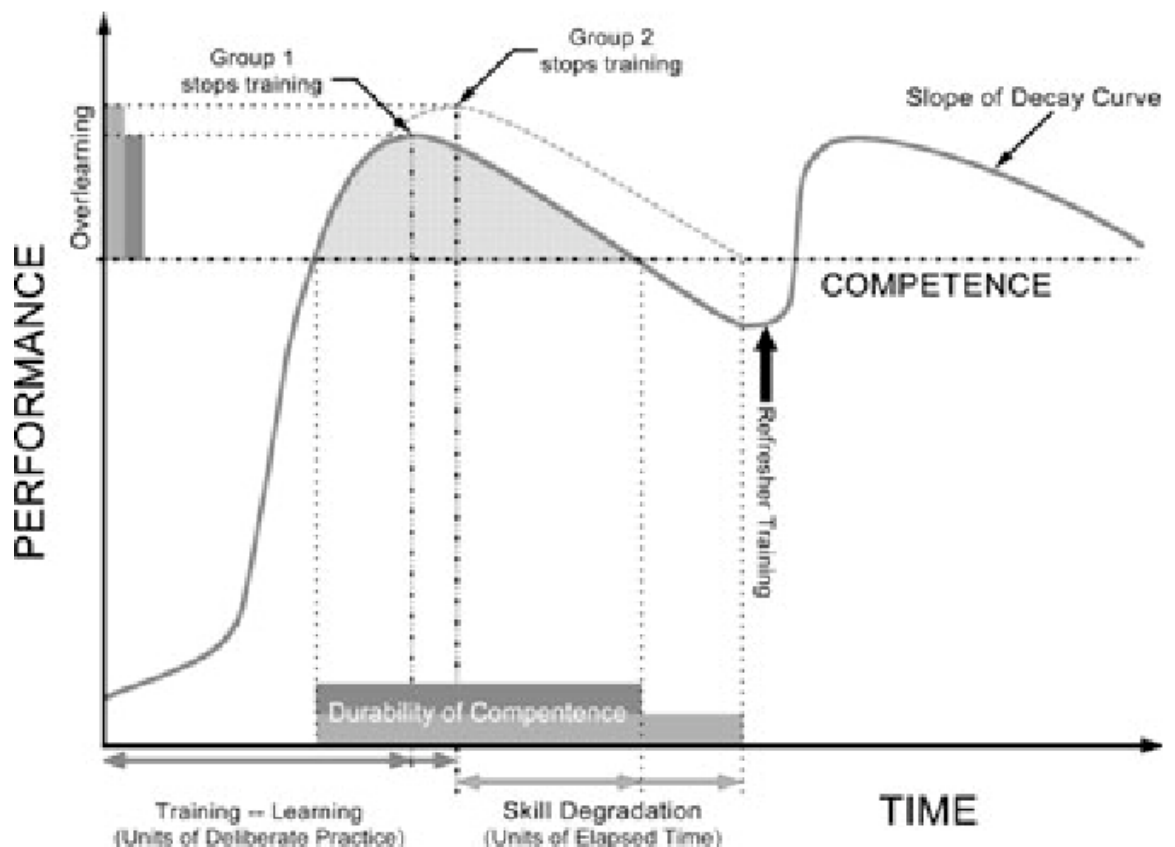


Figure 6.1, Experience Curves (Pusic *et al.*, 2012)

For many paramedic skills this will be a career long process due to the irregularity and, sometimes infrequent nature of certain areas of practice, as demonstrated in phase one of this study. The difficulty for individuals in practice will always lie in identification of skills gaps and time to undertake training and deliberate practice. Undergraduate students however, should benefit from the aforementioned spiral curriculum where they revisit similar content at increasing levels of complexity throughout their programmes of study. A potential issue occurs following the transition from education to practice, as demonstrated in this study some skills are very infrequent; anecdotally, there are paramedic skills that might only be performed once or twice in a career (needle cricothyroidotomy, needle thoracocentesis). The longer the gap between

training/education and using a skill in the real world, the greater the concerns should be over competence (Pusic *et al.*, 2012).

The degradation of a skill will also be affected by factors affecting memory, an article reviewing the literature around stress and acute medical care suggests that stress will impact memory (LeBlanc, 2009). This is particularly relevant when the infrequency of time critical incidents and associated skills is considered.

#### **6.9.4 Context of Learning**

The context of learning has also been shown to impact on the ability to recall information, as demonstrated in a dated but seminal study where participants learnt lists of words on dry land or under water and were then tested on them in the same or different environment, those learnt underwater were best recalled underwater and vice versa (Godden & Baddeley, 1975). This difference in memory performance was termed the 'same context advantage', it is suggested that this advantage is biggest when the skill/content being memorised is more simple; perhaps as a result of this, 'same context advantage' has not been shown to be so great for medical education, where skills are often complex in nature (Koens, Mann, Custers & Cate, 2005). Most universities utilise simulation, often within specific spaces (to provide context) as well as mandated practice placements within clinical settings (CoP, 2019; HCPC, 2018a), therefore offering 'same context advantage' to the greatest degree possible. A majority of participants for phase two were graduates and had therefore spent time in practice placement as well as participating in contextualised simulation. Results from phase two of this study are somewhat confusing with 'same context advantage' in mind, where one of the skills from the two highest

competence scores in the observed scenario was complex (Intermediate/advance airway management). An alternative view of the skills in phase two could have been that they were all complex to varying degrees and therefore less affected by the 'same context advantage'. Future research could explore performance in simulated and real environments to explore the same context concept further.

#### **6.10 Educational Background of Participants**

Phase two participants came from varying educational backgrounds and lengths of service. In relation to route to paramedic registration, more than 80% of participants were graduates; this is not reflective of the profession as a whole. This situation introduced the potential for participant bias within the study (Simundic, 2013).

Analysis of the data did not generally demonstrate differences in self-report scores or performance when comparing educational routes or years practicing as a paramedic. Later discussion regarding the practice of graduate and non-graduate paramedics within this section, may raise questions about whether this finding would have been the same if non-technical skills had been included within the scenario rubric. Degree paramedic courses include non-technical skills such as leadership, communication and decision making, whereas the traditional, non-university route to paramedic practice did not and was far more focussed on technical skills (Bradley, 2005; Lovegrove & Davis, 2013; Ryan & Halliwell, 2012).

A study conducted within the same ambulance trust area, used data from two distinct projects, one qualitative using analysis of case studies and one mixed methods using interviews and questionnaires. It explored the decision-making

approaches of paramedics specifically. It highlighted the surface learning, fact based approach traditionally employed prior to the development of higher education courses for paramedics. The authors concluded that although there may sometimes be a case for this in time pressured environments, contemporary practice for paramedics was better suited to use of deeper knowledge, generally required for the consideration of complex patient issues that involves use of non-technical skills. These can be developed through better encoding over a period of time, allowing more effective decision making by paramedics (Ryan & Halliwell, 2012). Although the findings of this paper feel intuitive, it lacked direct quotes of participants and there was no information about how the data were combined and analysed. This does not aim to suggest that graduate paramedics leave university as experts, in fact, an Australian study using focus groups concluded that on graduation paramedics are at the level of a novice (Willis, Williams, Brightwell, O'Meara & Pointon, 2010).

Traditionally entry level to the HCPC register sat at certificate level (academic level 4); following an evidence based review of this by the College of Paramedics (Lovegrove & Davis, 2013) and subsequent consultation carried out with by the HCPC, the decision was made that paramedicine will be an all graduate profession by 2021, a move long advocated for (AACE, 2011; Bradley, 2005) by the profession and stakeholders. This development was set to raise the cognitive level at which the profession can operate. In turn it would be proposed that clinical performance will also be maintained or improved in line with the higher levels of cognition associated with Blooms taxonomy, as discussed in chapter one.

### 6.10.1 Education for What?

Discussion around the challenges in education and clinical skills is demonstrated particularly well in various healthcare policy documents, with the recognition that major trauma/critical illness accounts for less than ten percent of the UK paramedic's workload but has traditionally taken approximately 90% of training/education time (AACE, 2011; Bradley, 2005). This Discussion highlights a mismatch between the paramedic curriculum and the actual workload, suggesting that too much time in education was spent preparing clinicians for life threatening incidents that they would infrequently see (Bradley, 2005; Kilner, 2004). However, in the context of the above discussion regarding learning and remembering how to practice clinical skills, considerable time is perhaps necessary, spread over time (Baddeley, Eysenck & Anderson, 2009; Ericsson, 2008; Pusic *et al.*, 2012) . There is perhaps scope for use of carefully considered educational programmes that utilise time efficient learning theories shown to be highly effective such as spaced retrieval with the practise of skills at increasing intervals (Carpenter, Cepeda, Rohrer, Kang & Pashler, 2012). On the other hand, a paper using data from a Delphi study analysed key attributes for UK prehospital clinicians (ambulance technicians, paramedics and clinical supervisors). The results indicated that, non-higher education background ambulance technicians and paramedics were skills focussed. It suggested that they had not spent enough time practising the various soft and hard skills required for the incidents/situations that they would actually encounter (Kilner, 2004).

A literature review conducted in 2005 examined UK studies published between 1995 and 2004 related to future demands on the paramedic in the primary care setting, basic skills and training (Ball, 2005). It further confirmed that paramedic

education and training for paramedics did not accurately reflect the reality of the role. Furthermore, it identified that the breadth of possible on scene diagnoses that paramedics might have to make, suggesting that these are beyond the scope of traditional paramedic practice (Ball, 2005). This raises further questions about the educational balance between preparing for commonly encountered situations without time pressures and time critical patients, who must be managed swiftly and effectively, despite the infrequent nature of incident/skill exposure for paramedics.

### **6.11 Summary**

This chapter has explored the complicated issue of what constitutes a clinical skill and how this links to paramedic practice in light of the findings from phase one and two. It identified 'softer' skills such as communication, consent and clinical reasoning, acknowledging their importance as well as the fact that considering skills in simplistic soft/hard context is unrealistic. Discussion explored why paramedic participants might not give the softer part of a skill, such as consent, the same importance as the technical aspects.

Considerable thought was given to performance, actual and perceived, as well as the nature of the paramedic role and the specific issues this presents for practice. Education is obviously important to performance and this chapter identifies multiple aspects/theories that impact on this, such as the importance of encoding, deliberate practice and forgetting curves, all of which considerably influence performance.

In addition to discussion around performance, the concept of perceived performance was explored. The Dunning-Kruger effect proposes that people have unfavourably high views of their own competence and that those same

people are not able to recognise their own incompetence. The findings from phase two largely refuted this, suggesting that paramedics are insightful about their own performance; this said, participants did struggle to predict what skills they would be best/worst at, believing that oxygen administration would be easiest, these were not the findings of the phase two results.

Finally, the chapter explores educational routes for paramedics and the challenges in preparing new paramedics for the role that they will be entering.

## **Chapter Seven: Conclusion/Recommendations**

### **7.0 Introduction**

This study aimed to establish incidents attended and skills used by paramedics in a UK ambulance service; further, it explored actual and perceived competence and confidence.

In this chapter, the study findings are summarised in the context of the study objectives before providing a critique of the study strengths and limitations.

Finally, the contributions made to knowledge, practice, methodology and education are articulated and recommendations proposed for future research, practice and education. The chapter concludes with personal reflections on the PhD journey.

### **7.1 Summary of the Findings**

During phase one, review of broad incident groups showed that 'trauma' was the most frequent group accounting for almost a quarter of all incidents. The most commonly recorded broad groups are nebulous in nature. Review of the most frequent provisional diagnosis codes shows a more focussed picture, different to that of the broad groups, where trauma does not appear; 'acute abdomen' was the most frequent, followed by 'medical other' and then acute coronary syndrome.

Frequency of incidents showed no significant differences when considering geographical areas (urban and rural). Similarly, no significant differences were found in relation to time of year and incidents attended.



The initial phase did show the stark infrequency of incidents that are perhaps considered commonplace both anecdotally and in the literature (AACE, 2011; Bradley, 2005). Major trauma and cardiac arrest, both highly time critical situations, accounted for less than 1% of the incidents reviewed.

Review of clinical the skills used at incidents highlighted the infrequent nature of interventions such as airway management and intraosseous access. Airway management (of all types) was recorded in only 1% of records reviewed, no records showed intraosseous access; again, these are often considered commonplace paramedic interventions. No significant difference was found for the location and time of year in relation to airway management.

During the review of clinical records, some skills were identified as frequent in their use, in particular, the recording of patient observations, intravenous cannulation and administration of drugs (enteral and parenteral routes).

Successful intravenous cannulation was recorded in almost a quarter of all patient contacts, similar to other skills already mentioned, no difference in frequency of this skill was identified between area or time of year.

Drug administration of some form was identified in over a half of the records reviewed, logic suggests that this was driven by the incident type and patient condition, rather than the location or time of year.

Phase two of the study looked to establish clinicians' competency/confidence in relation to clinical skills used by paramedics, this was done through the use of an evaluated clinical scenario with completion of a questionnaire before and after it. The skills for the clinical scenario were informed by the results from phase one, where a combination of frequent/infrequent and simple/complex skills were identified. Phase two also explored paramedic perception of

performance in relation to clinical skills and included open ended questions to allow better understanding of this.

Participants from phase two of the study were largely young (20-29 years old) university educated paramedics, with a mean of 4.14 years in practice. Pre-scenario questionnaires showed that out of the evaluated skills, participants were most confident, and felt they would be most competent in, oxygen administration. They felt the opposite about intermediate/advanced airway management. This finding was mirrored by the post scenario questionnaire, where over half of participants identified oxygen administration as the easiest skill. Positive correlation was shown between pre/post scenario confidence and competence in all of the skills used in phase two.

Contrary to the self-report scores already mentioned, the actual performance scores were highest in basic airway management followed by intravenous cannulation, then intermediate/advanced airway management and lastly oxygen administration. When asked in the post scenario questionnaire, only 10% of candidates said that they found basic airway management the easiest.

Generally, the demographic data did not show correlation with the confidence/competence and actual performance scores; however, there were a couple of points of interest; a positive correlation between oxygen administration scores and Practice Educators and a negative correlation with Practice Educators and intermediate/advanced airway management. This result indicated that Practice Educators scored higher during administration of oxygen and lower when managing a patient's airway using intermediate methods. Viewed simply, this may have occurred because administration of oxygen is a 'simple' skill in comparison to intermediate airway management. Bearing in mind the discussion around the different dimensions of clinical skills

it could also indicate that paramedics who have taken on an educational role may score better results in a skill that has a greater non-technical focus. Open ended questions in the post observation questionnaire sought information about factors that might affect confidence/competence. The answers from these questions were refined into four main themes, from most to least frequent, these were;

- Experience/exposure to skills/situations
- Personal (FTP – tiredness, illness etc)
- Environment/scene
- Education type/frequency of education opportunity

## **7.2 Strengths of the Study**

This study took a complex question that invited more than a one dimensional, qualitative or quantitative approach and used mixed methods to seek answers and information; this is a previously highlighted benefit of the mixed methods methodological approach, where more traditional methods alone would not have offered the same insight into the situation (Creswell, 2014; Creswell & Plano-Clark, 2017). In addition to this the use of a scoping review established what literature already existed as well as key themes within this.

The first phase of this study provided evidence to inform the design of the scenario for phase two; specifically, it identified frequent/infrequent, simple/complex skills. These skills were then planned into a scenario that included a combination of a frequent and infrequent incident that was relatable to practice and therefore realistic. This detail during a clinical simulation is important in order to offer a sense of reality (Weller, Nestel, Marshall, Brooks & Conn, 2012).

One purpose of the study was to explore the insight of paramedics in relation to their performance. The design of phase two enabled this exploration, where participants were able to offer their perception about their own clinical practice prior to the scenario, and then post scenario through the use of questionnaires. This final questionnaire allowed the investigation into the participant's insight. The pre and post scenario questionnaires allowed for comparison of self-perception data pre and post scenario.

### **7.3 Limitations of the Study**

During analysis of the phase one data it became apparent that a larger sample of PCRs would have offered a more detailed picture of the frequently attended provisional diagnosis codes, allowing for greater specificity during analysis, this is despite the sample calculations and the assertion that a sample of 600 should ensure that the study was adequately powered, avoiding a type two error (Charter, 1999; Naing, Winn & Rusli, 2006). This issue is likely a result of the large number of potential provisional diagnosis codes being recorded (145), meaning that within the sample of 600, some of the results were too small to allow calculations of significance (Field, 2013).

Widening the data collection to include qualitative aspects of the PCR would also perhaps have offered better insight into frequency of skills; this potential was best demonstrated with the identification of incomplete practice when recording a stepwise approach to managing the airway (see section 6.5.2).

The study design excluded patients not conveyed to hospital; this decision was taken in acknowledgement that skills/interventions completed for a patient not conveyed would be minimal. However, exclusion of this group meant that some data in relation to incident types was not included in the analysis; in addition,

the author acknowledges that following review of the clinical skills literature (chapter three), the assertion that skills would not be performed on non-conveyed patients is likely incorrect. Inclusion of this group may have altered the results and identified high frequency incidents/skills. This limitation was also identified during peer review of a manuscript that reported phase one results.

A retrospective review of ambulance service clinical records in Ireland, examining adherence to chest pain guidelines, highlights that the nature of retrospective review means that incomplete/inaccurate documentation can cause issues due to missing or inaccurate data (Figgis, Slevin & Cunningham, 2010); this may therefore, also be the case with phase one of this study.

The method used to evaluate the competence of participants during phase two of this study was a simulated scenario, the author is aware that the process of being observed may change the behavior of participants (McCambridge, Witton & Elbourne, 2014), consideration of a design using observed, actual clinical practice may have mitigated this.

Analysis of the phase two participant demographics showed that they were largely young (20-29 years old) university educated paramedics, with a mean of 4.14 years in practice. Reasons for this could be many but it does mean that there was potential for selection bias in the studies participants (Simundic, 2013). This does mean that the results could have been skewed, with many participants entering practice within the last four years, meaning they would likely have undertaken a degree programme and as a result may be more familiar with role-play and scenario participation. Any possible selection bias could have been avoided through more targeted recruitment.

In addition to the potential for recruitment bias, previous suggestion has been that people will alter their behavior if they know that they are being watched, as identified in a study looking at workers' productivity, by Roethlisberger and Dickson in 1939, later termed the Hawthorne effect. However, later literature suggested that this effect was a result of other external factors and that there was no empirical evidence to support it (Bowling, 2014).

### **7.3.1 Chief Investigator as Scenario Actor**

During the process of data collection for phase two, some challenges in relation to participant recruitment led to the arrangement/cancellation of data collection days at short notice. This made recruitment of an actor challenging; as a result, several months into data collection (at participant 21), a decision was made by the chief investigator to 'play' the part of the patient, as well as evaluating the scenario. This decision streamlined the planning process, allowing more flexibility in the recruitment and planning of the data collection days, the ability to make these decisions, to overcome threats to data collection is acknowledged in the literature (Lacono, Brown & Holtham, 2009).

The above actions could potentially introduce bias, whilst being wary of this and the possible threats it poses, it should be acknowledged that all research contains some bias, although it this can present issues with validity and reliability (Noble & Smith, 2015). In such situations, the issue should be explored so alternative methods can be considered if necessary (Grimes & Schulz, 2002).

The results from those who undertook the scenario with the chief investigator as an actor (n=37) and those who did not (n=20), were compared. Scenario scores (across all skills) showed no significant difference between the

groups,  $X^2 (28, n=57) = 38.34$ ,  $p=0.092$ , this indicated that significant bias had not been introduced through this course of action.

Examination of the data then looked specifically at oxygen administration and intravenous access elements of the scenario, these were the two skills that involved interaction with the actor and therefore the part of the scenario where any potential effect would be best identified. The other skills basic and intermediate/advanced airway management were both performed on a manikin. No significance was found when scores for the oxygen administration and intravenous cannulation were compared across the 'actor' and 'chief investigator as actor' group; oxygen administration,  $X^2 (17, n=57) = 13.3$ ,  $p=0.716$  and intravenous cannulation,  $X^2 (12, n=57) = 7.611$ ,  $p=0.815$ . Comparison of demographics showed no significant difference between the groups with age,  $X^2 (4, n=57) = 2.661$ ,  $p=0.616$ , or gender,  $X^2 (1, n = 57) = 2.067$ ,  $p = 0.094$ .

#### **7.4 Contribution to Knowledge**

Phase one of this study has offered a profession specific, UK focussed, detailed insight into the types of incident and skills practiced by paramedics in one ambulance service; this was something that had not previously been explored, as shown through the literature search. This knowledge is of particular value in relation to the second phase of the study; however, it also informs the wider profession, at a point in its development where specialist practice is becoming the norm (CoP, 2018b; CoP, 2019).

Understanding the frequency of incidents attended and skills used offers useful information to the profession, regulator, NHS organisations and education institutes who are concerned with the practice of paramedics. On an individual

level, understanding the frequency of certain incidents as well as clinical skills by paramedics may alleviate concerns over their experience, particularly early in their careers, a position most of the participants from this study were in (Kennedy, Kenny & O'Meara, 2015).

Phase two of this study showed that despite some of the literature around competence and confidence, suggesting that people are unskilled and unaware or skilled and unaware (Krueger & Mueller, 2002; Kruger & Dunning, 1999; Kruger & Dunning, 2002), paramedics don't necessarily suffer this effect, certainly not across all skills at least. The results did suggest however, that paramedics may lack confidence in the skills that they practice irregularly, such as basic airway management. The results also showed a correlation between confidence and competence, suggesting that if competence of paramedics can be increased then they will likely become more confident.

Discussion following phase two led to questions of what is considered a clinical skill and the various dimensions that make up such skills, an example of this is the inclusion of soft skills such as communication (Laker & Powell, 2011). This was shown where a notable proportion of participants sought incomplete consent. Paramedics perhaps see this more simplistically, not paying attention to the cognitive dimension, and would benefit from considering interventions from a more holistic perspective.

## **7.5 Contribution to Practice/Education**

Phase one of this study has highlighted the stark infrequency of some incidents such as major trauma and cardiac arrest, as well as the similar infrequency in performing some clinical skills such as airway management and intraosseous access. Furthermore, it has identified a dynamic, potentially time critical nature



to this issue, meaning skills must be performed swiftly and competently (AACE, 2011; Bradley, 2005; NAO, 2010; NCEPOD, 2007).

Phase two showed widespread good practice throughout a scenario involving a common cardiac presentation (ACS) that deteriorated, eventually suffering a cardiac arrest, a less common presentation, as previously discussed.

Understanding the issues around competence in infrequently practised skills allows discussion around preparation for the infrequent serious incidents and the frequent less serious incidents (Bradley, 2005; CoP, 2015), such as planning for time allocation/education.

Open ended questions from phase two provided some insight into the reasons that paramedics felt the way they did about their confidence/competence. Two of these link specifically with the points raised above; experience/exposure to skills/situations and the environment that they are practising in. During higher education programmes of study these concerns can be addressed through focused clinical simulation with set scenarios and learning outcomes, ending in structured feedback (Ericsson, 2008).

From a practice perspective, these are very difficult to address despite the potential impact on performance. Time for self-directed study during contracted hours would allow the practice of skills/scenarios; furthermore, if this were facilitated by ambulance service educators the practice could become 'deliberate', with specific learning outcomes and feedback provided to promote continual development (Ericsson, 2008; Ericsson, Krampe & Tesch-Romer, 1993).

Paramedics working for the local ambulance trust currently undergo annual 'learning development review' shifts; there is no time protected within this to discuss performance and highlight any issues with practice. Building in such

protected time for this activity would offer chance to feedback/forward to clinicians, thus improving their awareness.

A combination of both the above ideas would seem logical, where paramedics spent part of a shift being observed which then fed into a facilitated development session, based on discussions and performance during the part-shift earlier that day. This would provide a tailored approach, for the paramedic.

Drug administration and intravenous cannulation were both identified as commonly performed skills during phase one. This should mean that some of the issues around familiarity, mentioned above, are mitigated. Although this may well be the case, some problems were identified within even these commonly encountered skills; most notable, as already mentioned, was consideration of consent and the importance of seeking this in a full and open way. Continued and further consideration of frequent skills performance during education may prevent issues here and ensure that paramedics continue to maintain the standards expected of them (HCPC, 2014; HCPC, 2018c), offering due consideration of the non-technical aspects of skills.

There must be opportunities for focussed, deliberate practise for graduates as they continue into their careers following their graduation, where they will be expected to maintain their competence (HCPC, 2014) as part of their registration. The need for this, particularly with infrequent skills has been highlighted in relation to forgetting curves (Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012). It seems reasonable to suggest that ambulance services would benefit from developing systems for paramedics to be able to spend time refreshing skills and maintaining competence and confidence.

## **7.6 Contribution to methodology**

The use of mixed methods when researching emergency care, although not as commonplace as purely quantitative or qualitative approaches, is a methodology growing in popularity (Cathain, Murphy & Nicholl, 2007). The validity of it within this field of healthcare has previously been discussed and demonstrated (Cooper, Porter & Endacott, 2011).

The choice to use a mixed methods approach for this study offers further weight to an even newer field of research: prehospital care. Its' use adds to the literature, not only for emergency care but paramedicine more specifically. This study has shown that it is possible to use a mixed approach to investigating a complex situation within paramedicine.

The use of this methodology within a new and under-researched area of practice (as mentioned above) further strengthens the case and credibility of mixed methods studies, bringing them further into the consciousness of researchers and clinicians alike. It also offers insight into what works well with this type of study and potential issues.

A secondary contribution may be considered the education value provided by this methodological approach for the participants. Anecdotally, they reported that the process of completing a questionnaire before and after a clinical scenario facilitated focussed reflection on their own practice in a way that they do not often have opportunity. Although it may be suggested that this is not different to participation in any other research project, the specific design of this study enabled deeper reflection through exploration of thoughts and perceptions as well as measurement of performance. With feedback provided,

this process could be argued to provide the insight that is vital to ensure realistic perception of one's self (Kruger & Dunning, 1999).

### **7.7 Contribution to Theory**

Examining the theory in isolation can present an over simplistic picture of the situation with clinical skills of varying complexity and frequency; applying the pre hospital, paramedic context has shown how concepts such as the Dunning Kruger effect are not necessarily evident across all aspects of the skills used, but may exist in some way. Reasons for this limited link may be many; however much of Kruger and Dunning's work included students still studying, from very different professional areas (Kruger & Dunning, 1999; Kruger & Dunning, 2002).

Participants in this study were all practicing professionally, albeit for various lengths of time, so had gained experience of some description in their roles. This would have given an opportunity, of varying degrees, to learn and develop through reflection, as they move from novice to expert (Benner, 1982).

Generally scores from the clinical scenario were good and participants demonstrated a broadly realistic view of their own ability. There were some findings contradictory to this, with the suggestion by participants that oxygen administration was the easiest of the four specific scenario skills, logical as it was selected as the frequent, simple skill option in the study design. This was not borne out by the results where participants' scores for this part of the scenario were lower than others. Conversely, participants felt under confident and under competent in basic airway maintenance, a skill that they scored the highest in during the scenario.

The large proportion of graduate participants (81.16%, n=56) in phase two of the study came from education programmes which include sustained periods of

focussed learning, using learning outcomes and offering feedback; the importance of this was highlighted in literature, which cites the importance of 'deliberate practice' and the quality of 'encoding' when learning clinical skills (Ericsson, 2008; Ericsson, Krampe & Tesch-Romer, 1993; Ericsson, 2004; Pusic, Pecaric & Boutis, 2011; Pusic *et al.*, 2012).

In relation to figure 1.3 (Factors for competence in clinical practice, chapter one), development of the way this is viewed has been possible following completion of this study, the results of which have put less emphasis on simply having to perform the skills, there is now acknowledgement that performance can improve and deteriorate. In addition, acknowledgement of personal factors has also been found to be particularly important bearing in mind the short answers from participants, figure 7.1 shows these theoretical revisions.

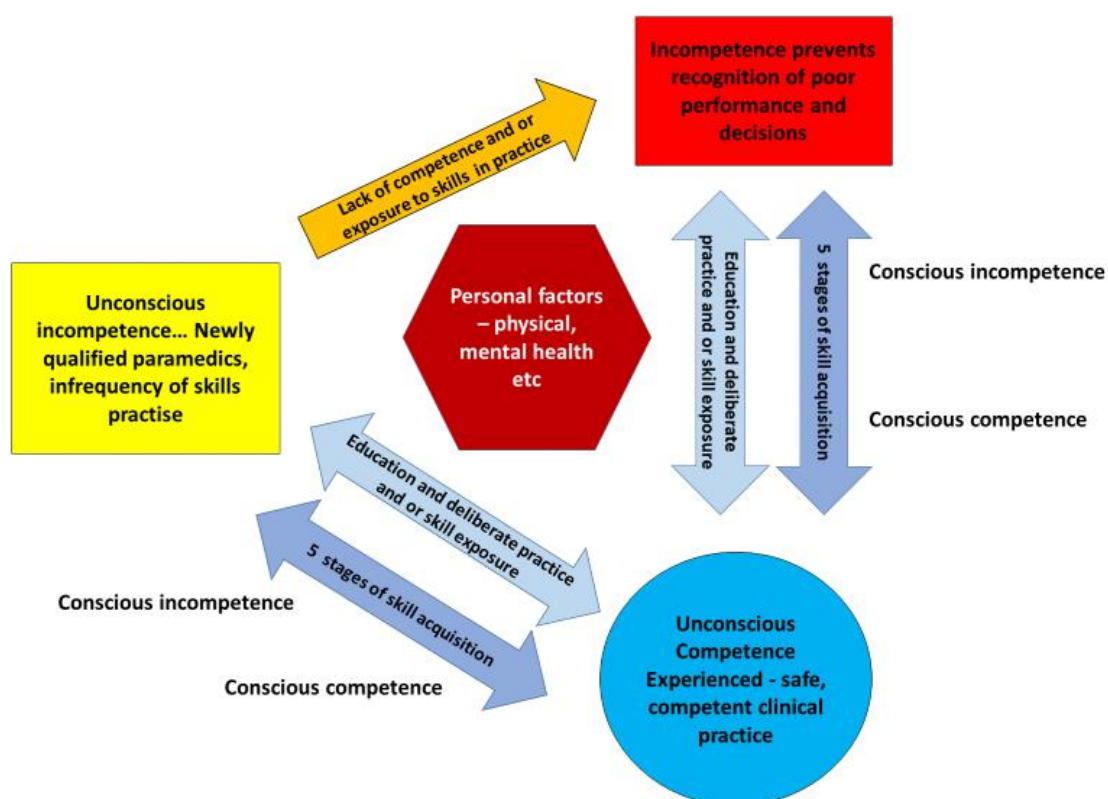


Figure 7.1, Revised Factors for Competence in Clinical Practice

Phase two of this study has provided evidence that the Dunning Kruger effect is not universal but some elements of it may exist alongside other concepts such as deliberate practice; in addition, experience curves may aid understanding of how best to manage performance along with appreciation of the challenging paramedic role and factors such as stress and anxiety that exist within it. This all comes together to feed into a complex situation with no simple solution.

### **7.8 Recommendations for Future Research**

Future studies in this area may offer a more detailed, authentic picture of the situation if they used an observational participatory design, such as observation of paramedics in their real practice setting, as discussed in a review of literature based around simulation and assessment (Schuwirth & Van der Vleuten, 2003). Whilst presenting challenges for ethics approval and taking of informed consent, this would provide insight into additional factors that could affect performance, such as stress and complex environmental cues.

Better understanding could also be obtained from collecting data in multiple sites. For phase one, this would offer a wider, national picture of incident frequency rather than the current regional one previously discussed. In addition, recording of free-written data might improve the quality of the data collected. Following this route for a future study would require development of a universal data collection tool in relation to incident grouping and codes, taking into account the various clinical records used by Ambulance Trusts.

Collection of data for phase two, from participants across the UK would also offer a more detailed picture of practice within different ambulance services, with paramedics who have graduated from a wider range of universities. Considering perceptions and experiences, it would be interesting and valuable for the development of education to explore paramedics' feelings and thoughts about confidence and competence through the use of qualitative methodology such as focus groups and semi-structured interviews.

### **7.9 Personal Reflections**

I developed an interest in the area of confidence and competence within paramedic practice a couple of years prior to commencing my PhD journey. It was largely driven by a career as a paramedic and my transition to a full time lecturing role on a paramedic degree programme; this move saw me leading two clinical skills modules and during contact with students on this module I began to recognise what I perceived as common themes, such as a lack of insight into competence, and anxiety about skills and incidents that are not encountered regularly. When I considered my own experiences, I recognised some common concerns about exposure to various aspects of the role, confidence and how to maintain competence.

I was excited to be given the opportunity to develop my ideas and thoughts into a PhD proposal; however, I had significant concerns as I had not previously undertaken research of this nature and felt that both my research knowledge and experience was limited. During the early stages of my PhD, I focussed heavily on the more practical elements of my work, planning for data collection during both phases for example, I recognise now that I was avoiding the vitally

important philosophical element, which I found challenging to understand and contextualise.

During my transfer from MPhil to PhD, I received feedback that although I had been successful, I needed to demonstrate greater understanding of the philosophical underpinnings of my study. In addition, the examiner noted that I still presented myself as a paramedic who had been working on research, rather than a researcher in their own right.

Following the transfer, my supervisory team encouraged me to take some time to immerse myself in the philosophical literature. Although I understood and agreed with the feedback given by the examiner, at this point in my journey I felt that my outlook changed. Up to this point, I had felt like I was making good progress and was positive; however, following this I struggled to motivate myself for a period of time. As I developed the philosophical viewpoint and approach to my work, I again felt like I was making progress and started enjoying the research more.

The above, in combination with the knowledge and experience gained during design of the study and analysis of the data have given me the confidence to explore research more widely. My work on this particular study developed my interest in mixed methods research and the philosophical approach of the pragmatist. I felt like this worked well for the prehospital environment and found it much easier to contextualise. I believe that this will allow me continue my journey as a researcher, rather than a paramedic doing research.

## **7.10 Summary**

This study, and chapter has demonstrated the complexity of clinical skills, both in their nature (technical/non-technical) and also in the context of learning and



memory, where initial coding and frequency of practice play a key role. It highlighted that paramedic participants did not always have insight into their own competence; also, that they sometimes missed key components of a skill. Reasons for this were not explored in depth here but may be due to the previously mentioned complexity of skills, level of expertise and consideration of the dynamic environment in which they practice.

Maintenance of competence through simulation in context and deliberate practice is vital. Consideration of learning curves enables appreciation by individuals of the importance of these activities as well as understanding regarding the process of skill decay. Another area for consideration by paramedics, is what they should focus their continued learning and development on; the serious infrequent, or less serious, frequent incidents.

The concept of learning to the point of competence and then maintaining ability or further developing to a level of expertise is in its own right challenging. There is interplay between competence, insight and personal factors such as confidence. All of these things can improve and decline, depending on experience, exposure and education of an individual.

This study has taken various concepts, many not previously considered within prehospital care, and brought them together to offer a fresh view of contemporary paramedic practice within a UK ambulance service. Bearing them in mind when designing new and ongoing education will help to ensure paramedics are prepared for the role expected of them. Looking to the future, similar studies investigating a wider geographical area and the paramedics within would help to understand the national picture of any skill/incident frequency issue. Achieving this through data collection in a real setting might provide a more representative view.

## References

AACE (2011) *Taking Healthcare to the Patient 2: a review of 6 years' progress and recommendations for the future*. UK. Available.

Almalki, S. (2016) 'Integrating Quantitative and Qualitative Data in Mixed Methods Research--Challenges and Benefits'. *Journal of Education and Learning*, 5 (3), pp. 288-296.

Arksey, H. & O'Malley, L. (2005) 'Scoping studies: towards a methodological framework'. *International journal of social research methodology*, 8 (1), pp. 19-32.

Armstrong, R., Hall, B., Doyle, J. & Waters, E. (2011) 'Scoping the scope' of a cochrane review'. *Journal of public health*, 33 (1), pp. 147-150.

Baddeley, A., Eysenck, M. W. & Anderson, M. (2009) 'Memory. East Sussex'. [in Psychology Press. (Accessed:Baddeley, A., Eysenck, M. W. & Anderson, M.

Ball, L. (2005) 'Setting the scene for the paramedic in primary care: a review of the literature'. *Emergency Medicine Journal*, 22 (12), pp. 896-900.

Barelli, A. & Scapigliati, A. (2010) 'The four-stage approach to teaching skills: The end of a dogma?'. *Resuscitation*, 81 (12), pp. 1607-1608.

Bazeley, P. (2013) *Qualitative data analysis: Practical strategies*. Sage.

Beauchamp, T. L. & Childress, J. F. (2001) *Principles of biomedical ethics*. Oxford University Press, USA.

Benbassat, J., Bauml, R., Heyman, S. & Brezis, M. (2005) 'Viewpoint: Suggestions for a Shift in Teaching Clinical Skills to Medical Students: The Reflective Clinical Examination'. *Academic medicine*, 80 (12), pp. 1121-1126.

Benger, J. R., Kirby, K., Black, S., Brett, S. J., Clout, M., Lazaroo, M. J., Nolan, J. P., Reeves, B. C., Robinson, M. & Scott, L. J. (2018) 'Effect of a strategy of a Supraglottic airway device vs tracheal intubation during out-of-hospital cardiac arrest on functional outcome: the AIRWAYS-2 randomized clinical trial'. *Jama*, 320 (8), pp. 779-791.

Benner, P. (1982) 'From Novice to Expert'. *The American Journal of Nursing*, 82 (3), pp. 402-407.

Bjørk, I. T. & Kirkevold, M. (1999) 'Issues in nurses' practical skill development in the clinical setting'. *Journal of nursing care quality*, 14 (1), pp. 72-84.

Blaber, A. (2012) *Foundations for paramedic practice: a theoretical perspective*. McGraw-Hill Education (UK).

- Blanch-Hartigan, D. (2011) 'Medical students' self-assessment of performance: results from three meta-analyses'. *Patient education and counseling*, 84 (1), pp. 3-9.
- Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H. & Krathwohl, D. R. (1956) *Taxonomy of educational objectives: the classification of educational goals: handbook I: cognitive domain*. New York, US: D. Mckay. Available.
- Bobrow, B. J., Spaite, D. W., Berg, R. A., Stolz, U., Sanders, A. B., Kern, K. B., Vadeboncoeur, T. F., Clark, L. L., Gallagher, J. V. & Stapczynski, J. S. (2010) 'Chest compression-only CPR by lay rescuers and survival from out-of-hospital cardiac arrest'. *Jama*, 304 (13), pp. 1447-1454.
- Bowling, A. (2014) *Research methods in health: investigating health and health services*. McGraw-hill education (UK).
- Bradley, P. (2005) 'Taking healthcare to the patient: transforming NHS ambulance services'. *Department of Health, London*,
- Brady, F. (2008) 'The contextual interference effect and sport skills'. *Perceptual and motor skills*, 106 (2), pp. 461-472.
- Brewer, J. & Hunter, A. (1989) *Multimethod research: A synthesis of styles*. Sage Publications, Inc.
- Brooks, I. A., Cooke, M., Spencer, C. & Archer, F. (2016) 'A review of key national reports to describe the development of paramedic education in England (1966–2014)'. *Emerg Med J*, 33 (12), pp. 876-881.
- Byrne, A., Pugsley, L. & Hashem, M. (2008) 'Review of comparative studies of clinical skills training'. *Medical teacher*, 30 (8), pp. 764-767.
- Campeau, A. (2015) 'Why paramedics require “theories-of-practice”'. *Australasian Journal of Paramedicine*, 6 (2),
- Carley, S. (2007) 'Are you an evidence based emergency physician?'. *Emergency Medicine Journal*, 24 (9), pp. 611-613.
- Carpenter, S. K., Cepeda, N. J., Rohrer, D., Kang, S. H. & Pashler, H. (2012) 'Using spacing to enhance diverse forms of learning: Review of recent research and implications for instruction'. *Educational Psychology Review*, 24 (3), pp. 369-378.
- Carraccio, C. L., Benson, B. J., Nixon, L. J. & Derstine, P. L. (2008) 'From the educational bench to the clinical bedside: translating the Dreyfus developmental model to the learning of clinical skills'. *Academic medicine*, 83 (8), pp. 761-767.
- Castenelli, D. (2009) 'The rise of simulation in technical skills teaching and the implications for training novices in anaesthesia'. *Anaesthesia and Intensive Care*, 37 (6),

- Cathain, A., Murphy, E. & Nicholl, J. (2007) 'Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study'. *BMC Health Services Research*, 7 (85),
- Catterall, M. (2012) 'The role of paramedics with extended practice: exploring the healthcare context'. *Journal of Paramedic Practice*, 4 (10), pp. 569-575.
- Chalk, D., Black, S. & Pitt, M. (2016) 'Which factors most influence demand for ambulances in South West England?'. *Journal of Paramedic Practice*, 8 (7), pp. 356-367.
- Chan, S. W., Tulloch, E., Cooper, E. S., Smith, A., Wojcik, W. & Norman, J. E. (2017) 'Montgomery and informed consent: where are we now?'. *Bmj*, 357 pp. j2224.
- Charter, R. A. (1999) 'Sample size requirements for precise estimates of reliability, generalizability, and validity coefficients'. *Journal of Clinical and Experimental Neuropsychology*, 21 (4), pp. 559-566.
- Cherryholmes, C. H. (1992) 'Notes on pragmatism and scientific realism'. *Educational researcher*, 21 (6), pp. 13-17.
- Chopra, V., Gesink, B. J., DE JONG, J., Bovill, J., Spierdijk, J. & Brand, R. (1994) 'Does training on an anaesthesia simulator lead to improvement in performance?'. *British Journal of Anaesthesia*, 73 (3), pp. 293-297.
- Cleary, T. & Sandars, J. (2011) 'Assessing self-regulatory processes during clinical skill performance: A Pilot Study'. *Medical teacher*, 33 (7), pp. e368-e374.
- Coiera, E. W., Jayasuriya, R. A., Hardy, J., Bannan, A. & Thorpe, M. E. (2002) 'Communication loads on clinical staff in the emergency department'. *Medical Journal of Australia*, 176 (9), pp. 415-418.
- Cooper, S. (2005) 'Contemporary UK paramedical training and education. How do we train? How should we educate?'. *Emergency Medicine Journal*, 22 (5), pp. 375-379.
- Cooper, S., Porter, J. & Endacott, R. (2011) 'Mixed methods research: a design for emergency care research?'. *Emergency Medicine Journal*, 28 (8), pp. 682-685.
- CoP (2015) *Paramedic Curriculum Guidance (3rd Edition)*. Bridgwater: College of Paramedics.
- CoP (2018a) 'Paramedic - Scope of Practice Policy'. [in Bridgwater: College of Paramedic. (Accessed:CoP
- CoP (2018b) 'Post Registration - Paramedic Career Framework (4th edition)'. [in Bridgwater: College of Paramedics. (Accessed:CoP

CoP (2019) *Paramedic Curriculum Guidance (5th edition)*. Bridgwater: College of Paramedics.

Creswell, J. W. (2014) *A concise introduction to mixed methods research*. Sage Publications.

Creswell, J. W. & Plano-Clark, V. L. (2017) *Designing and conducting mixed methods research*. Sage publications.

Crotty, M. (1998) *The foundations of social research: Meaning and perspective in the research process*. Sage.

Cunningham, L. M., Mattu, A., O'Connor, R. E. & Brady, W. J. (2012) 'Cardiopulmonary resuscitation for cardiac arrest: the importance of uninterrupted chest compressions in cardiac arrest resuscitation'. *The American journal of emergency medicine*, 30 (8), pp. 1630-1638.

Cunnington, J., Neville, A. & Norman, G. (1996) 'The risks of thoroughness: reliability and validity of global ratings and checklists in an OSCE'. *Advances in Health Sciences Education*, 1 (3), pp. 227-233.

Cypress, B. S. (2017) 'Rigor or reliability and validity in qualitative research: Perspectives, strategies, reconceptualization, and recommendations'. *Dimensions of Critical Care Nursing*, 36 (4), pp. 253-263.

Daudt, H. M., van Mossel, C. & Scott, S. J. (2013) 'Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework'. *BMC medical research methodology*, 13 (1), pp. 48.

Deakin, C., King, P. & Thompson, F. (2009) 'Prehospital advanced airway management by ambulance technicians and paramedics: is clinical practice sufficient to maintain skills?'. [in British Association for Accident and Emergency Medicine. (Accessed:Deakin, C., King, P. & Thompson, F.

DeAnda, A. & Gaba, D. M. (1991) 'Role of experience in the response to simulated critical incidents'. *Anesthesia and analgesia*, 72 (3), pp. 308-315.

Dewey, J. (1980) 'Art as experience: New York: GP Putnam's Sons'. [in Perigee Books. (Original work published in 1934). (Accessed:Dewey, J.

Dreyfus, S. E. (2004) 'The five-stage model of adult skill acquisition'. *Bulletin of science, technology & society*, 24 (3), pp. 177-181.

Dunning, D., Johnson, K., Ehrlinger, J. & Kruger, J. (2003) 'Why people fail to recognize their own incompetence'. *Current directions in psychological science*, 12 (3), pp. 83-87.

Dupanovic, M., Fox, H. & Kovac, A. (2010) 'Management of the airway in multitrauma'. *Current Opinion in Anesthesiology*, 23 (2), pp. 276-282.

- Edwards, M. (2014) *Academic Review of Demand 2013/14*. London. Available.
- England, H. (2017) 'Multi-professional framework for advanced clinical practice in England'. *London: Health Education England*,
- Ericsson, K. (2008) 'Deliberate practice and acquisition of expert performance: a general overview'. *Academic Emergency Medicine*, 15 (11), pp. 988-994.
- Ericsson, K., Krampe, R. & Tesch-Romer, C. (1993) 'The Role of Deliberate Practice in the Acquisition of Expert Performance'. *Psychological review*, 100 (3), pp. 363-406.
- Ericsson, K. A. (2004) 'Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains'. *Academic medicine*, 79 (10), pp. S70-S81.
- Ertmer, P. & Newby, T. (1993) 'Behaviorism, Cognitivism, Constructivism: Comparing Critical Features from an Instructional Design Perspective'. *Performance Improvement Quality*, 6 (4), pp. 50-72.
- Etikan, I., Musa, S. A. & Alkassim, R. S. (2016) 'Comparison of convenience sampling and purposive sampling'. *American journal of theoretical and applied statistics*, 5 (1), pp. 1-4.
- Eva, K. (2005) 'What every teacher needs to know about clinical reasoning'. *Medical education*, 39 (1),
- Evans, K., Walker, J. & Jackson, E. (2007) 'How much do emergency healthcare workers know about capacity and consent?'. *Emergency Medicine Journal*, 24 pp. 391-393.
- Evans, R., McGovern, R., Birch, J. & Newbury-Birch, D. (2014) 'Which extended paramedic skills are making an impact in emergency care and can be related to the UK paramedic system? A systematic review of the literature'. *Emerg Med J*, 31 (7), pp. 594-603.
- Falchikov, N. & Boud, D. (1989) 'Student self-assessment in higher education: A meta-analysis'. *Review of educational research*, 59 (4), pp. 395-430.
- Feilzer, Y. (2010) 'Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm'. *Journal of mixed methods research*, 4 (1), pp. 6-16.
- Field, A. (2013) *Discovering statistics using IBM SPSS statistics*. sage.
- Figgis, K., Slevin, O. & Cunningham, J. B. (2010) 'Investigation of paramedics' compliance with clinical practice guidelines for the management of chest pain'. *Emergency Medicine Journal*, 27 (2), pp. 151-155.

Fisher, J., Brown, S. & Cooke, M. (2013) *UK Ambulance Services Clinical Practice Guidelines*. Bridgwater: Class Publishing.

Gaisford, M. (2017) 'Informed consent in paramedic practice'. *Journal of Paramedic Practice*, 9 (2), pp. 80-85.

Gallagher, A., Snook, V., Horsefield, C., Rutland, S., Vyvyan, E., Juniper, J. & Collen, A. (2016) 'Experts' perspectives on professionalism in paramedic practice: findings from a Delphi process'. *British Paramedic Journal*, 1 (2), pp. 9-17.

Garside, J. & Nhemachena, J. (2013) 'A concept analysis of competence and its transition in nursing'. *Nurse Education Today*, 33 (5), pp. 541-545.

Godden, D. R. & Baddeley, A. D. (1975) 'Context-dependent memory in two natural environments: On land and underwater'. *British Journal of psychology*, 66 (3), pp. 325-331.

Goodwin, D., Mays, N. & Pope, C. (2006) *Ethical Issues: Qualitative Research in Health Care 3rd Edn*. Blackwell Publishing.

Gray, D. E. (2013) *Doing research in the real world*. Sage.

Greenhalgh, T. & Peacock, R. (2005) 'Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources'. *Bmj*, 331 (7524), pp. 1064-1065.

Gregory, P. & Mursell, I. (2010) *Manual of Clinical Paramedic Procedures*. London: Wiley.

Greif, R., Lars, E., Basciani, R., Lockey, A. & Vogt, A. (2010) 'Emergency skill training—A randomized controlled study on the effectiveness of the 4-stage approach compared to traditional clinical teaching'. *Resuscitation*, 81 (12), pp. 1692-1697.

Griffith, R. (2009) 'Elements of a valid consent to treatment in capable adults'. *Journal of Paramedic Practice*, 1 (5), pp. 196-203.

Grimes, D. A. & Schulz, K. F. (2002) 'Bias and causal associations in observational research'. *The lancet*, 359 (9302), pp. 248-252.

Guba, E. G. & Lincoln, Y. S. (2005) 'Paradigmatic controversies, contradictions, and emerging confluences'.

Harris, M. & Taylor, G. (2003) *Medical statistics made easy*. CRC Press.

Haun, D. E., Zeringue, A., Leach, A. & Foley, A. (2000) 'Assessing the competence of specimen-processing personnel'. *Laboratory Medicine*, 31 (11), pp. 633-637.

HCPC (2014) 'Standards of Proficiency for Paramedics'. [in London: Health and Care Professions Council. (Accessed:HCPC

HCPC (2015) *Preventing small problems from becoming big problems in health and care*. London: Health and Care Professional Council. Available.

HCPC (2018a) 'Standards of Education and Training'. Health and Care Professions Council. [Online]. Available at: <https://www.hcpc-uk.org/standards/standards-relevant-to-education-and-training/set/> (Accessed: 28/02/19).

HCPC (2018b) 'HCPC decision on threshold level of qualification for paramedics'. HCPC. [Online]. Available at: <http://www.hpc-uk.org/news-and-events/news/2018/hcpc-decision-on-threshold-level-of-qualification-for-paramedics/> (Accessed: 12/03/19).

HCPC (2018c) 'Standards of Conduct Performance and Ethics'. Health and Care Professions Council. [Online]. Available at: <https://www.hcpc-uk.org/standards/standards-of-conduct-performance-and-ethics/> (Accessed: 28/02/19).

HCPC (2018d) 'Standards of continuing professional development'. Health and Care Professions Council. [Online]. Available at: <https://www.hcpc-uk.org/standards/standards-of-continuing-professional-development/> (Accessed: 28/02/19).

Heale, R. & Twycross, A. (2015) 'Validity and reliability in quantitative studies'. *Evidence-based nursing*, 18 (3), pp. 66-67.

HEE (2019) 'Paramedic Specialist in Primary and Urgent Care Core Capabilities Framework'. [in Skills for Health, C.o.P. UK: Health Education England. (Accessed:HEE

Henderson, T., Endacott, R., Marsden, J. & Black, S. (2019) 'Examining the type and frequency of incidents attended by UK paramedics'. *Journal of Paramedic Practice*, 11 (9), pp. 396-402.

Herbert, F. (2005) 'Hyposkillia. deficiency of Clinical Skills'. *Texas Heart Institute Journal*, 32 (3), pp. 255-257.

Higginson, I. & Hicks, A. (2006) 'Unconscious incompetence and the foundation years'. *Emergency Medicine Journal*, 23 (11), pp. 887-887.

Hodges, B., Regehr, G. & Martin, D. (2001) 'Difficulties in recognizing one's own incompetence: novice physicians who are unskilled and unaware of it'. *Academic medicine*, 76 (10), pp. S87-S89.

Hope, A., Garside, J. & Prescott, S. (2011) 'Rethinking theory and practice: Pre-registration student nurses experiences of simulation teaching and learning in the acquisition of clinical skills in preparation for practice'. *Nurse Education Today*, 31 (7), pp. 711-715.



Howell, K. E. (2012) *An introduction to the philosophy of methodology*. Sage.

HRA (2020) 'What Approvals and Decisions do I need?'. [Online]. Available at: <https://www.hra.nhs.uk/approvals-amendments/> (Accessed: 11/02/2020).

Jansen, A. C., van Aalst-Cohen, E. S., Hutten, B. A., Büller, H. R., Kastelein, J. J. & Prins, M. H. (2005) 'Guidelines were developed for data collection from medical records for use in retrospective analyses'. *Journal of clinical epidemiology*, 58 (3), pp. 269-274.

Johns, C. (2006) *Engaging reflection in practice: A narrative approach*. Blackwell Pub.

Johnson, R. B. & Onwuegbuzie, A. J. (2004) 'Mixed methods research: A research paradigm whose time has come'. *Educational researcher*, 33 (7), pp. 14-26.

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007) 'Toward a definition of mixed methods research'. *Journal of mixed methods research*, 1 (2), pp. 112-133.

Johnstone, P. L. (2004) 'Mixed methods, mixed methodology health services research in practice'. *Qualitative health research*, 14 (2), pp. 259-271.

Jonsson, A. & Svingby, G. (2007) 'The use of scoring rubrics: Reliability, validity and educational consequences'. *Educational research review*, 2 (2), pp. 130-144.

JRCALC (2008) *A Critical Reassessment of Ambulance Service Airway Management in Pre-Hospital Care*. UK: Joint Royal Colleges Ambulance Liaison Committee. Available.

Juslin, P., Winman, A. & Olsson, H. (2000) 'Naive empiricism and dogmatism in confidence research: A critical examination of the hard–easy effect'. *Psychological review*, 107 (2), pp. 384.

Kennedy, S., Kenny, A. & O'Meara, P. (2015) 'Student paramedic experience of transition into the workforce: a scoping review'. *Nurse Education Today*, 35 (10), pp. 1037-1043.

Kidd, J., Patel, V., Peile, E. & Carter, Y. (2005) 'Clinical and communication skills'. [in British Medical Journal Publishing Group. (Accessed: Kidd, J., Patel, V., Peile, E. & Carter, Y.

Kilner, T. (2004) 'Educating the ambulance technician, paramedic, and clinical supervisor: using factor analysis to inform the curriculum'. *Emergency Medicine Journal*, 21 (3), pp. 379-385.

Kirby, K., Moreland, S. & Pollard, J. (2016) 'The impact of working shifts: exploring the views of UK paramedics'. *Journal of Paramedic Practice*, 8 (5), pp. 252-257.

- Kneebone, R., Kidd, J., Nestel, D., Asvall, S., Paraskeva, P. & Darzi, A. (2002) 'An innovative model for teaching and learning clinical procedures'. *Medical education*, 36 (7),
- Kneebone, R., Nestel, D., Vincent, C. & Darzi, A. (2007) 'Complexity, risk and simulation in learning procedural skills'. *Medical education*, 41 (8), pp. 808-814.
- Koens, F., Mann, K., Custers, E. & Cate, O. (2005) 'Analysing the concept of context in medical education'. *Medical education*, 39 (12), pp. 1243-1249.
- Krajc, M. & Ortmann, A. (2008) 'Are the unskilled really that unaware? An alternative explanation'. *Journal of Economic Psychology*, 29 (5), pp. 724-738.
- Krueger, J. & Mueller, R. A. (2002) 'Unskilled, unaware, or both? The better-than-average heuristic and statistical regression predict errors in estimates of own performance'. *Journal of personality and social psychology*, 82 (2), pp. 180.
- Kruger, J. & Dunning, D. (1999) 'Unskilled, unaware, or both? The better-than-average heuristic and statistical regression predict errors in estimates of own performance'. *Journal of personality and social psychology*, 77 (6), pp. 1121.
- Kruger, J. & Dunning, D. (2002) 'Unskilled and unaware--but why? A reply to Krueger and Mueller (2002)'.
- Lacono, J., Brown, A. & Holtham, C. (2009) 'Research Methods--a Case Example of Participant Observation'. *Electronic journal of business research methods*, 7 (1),
- Laker, D. R. & Powell, J. L. (2011) 'The differences between hard and soft skills and their relative impact on training transfer'. *Human Resource Development Quarterly*, 22 (1), pp. 111-122.
- Lauria, M., Gallo, I., Rush, S., Brooks, J., Spiegel, R. & Weingart, S. (2017) 'Psychological Skills to Improve Emergency Care Providers' Performance Under Stress'. *Annals of Emergency Medicine*, 70 (6), pp. 884-890.
- Lauria, M. J., Rush, S., Weingart, S. D., Brooks, J. & Gallo, I. A. (2016) 'Potential role for psychological skills training in emergency medicine: Part 1-Introduction and background'. *Emergency Medicine Australasia*, 28 (5), pp. 607-610.
- LeBlanc, V. (2009) 'The Effects of Acute Stress on Performance: Implications for Health Professions Education'. *Academic medicine*, 84 (10), pp. S25-S33.
- Levac, D., Colquhoun, H. & O'Brien, K. K. (2010) 'Scoping studies: advancing the methodology'. *Implementation Science*, 5 (1), pp. 69.
- Lewis, D. (2018) *Workplace Culture at Southwestern Ambulance NHS Foundation Trust*. Plymouth. Available.

- Lizarondo, L., Grimmer-Somers, K. & Kumar, S. (2011) 'A systematic review of the individual determinants of research evidence use in allied health'. *Journal of multidisciplinary healthcare*, 4 pp. 261.
- Lovegrove, M. & Davis, J. (2013) *Paramedic Evidence Based Project (PEEP) End of Study Report*. Available.
- Lucas, B. E. (1979) *Medical Commission on Accident Prevention; extended training for ambulance attendants*. . Bristol: Stonebridge Press.
- Lukasik, K. M., Waris, O., Soveri, A., Lehtonen, M. & Laine, M. (2019) 'The relationship of anxiety, stress and depressive symptoms with working memory performance in a large non-depressed sample'. *Frontiers in psychology*, 10 pp. 4.
- Mackay, S., Morgan, P., Datta, V., Chang, A. & Darzi, A. (2002) 'Practice distribution in procedural skills training'. *Surgical Endoscopy and Other Interventional Techniques*, 16 (6), pp. 957-961.
- Marmot, M. (2010) *Fair Society, Health Lives. The Marmot Review (Executive Summary)*. The Marmot Review.
- Marsh, D. & Furlong, P. (2002) 'A skin not a sweater: ontology and epistemology in political science'. *Theory and methods in political science*, 2 pp. 17-41.
- Maxell, J. & Mittapalli, K. (2010) *Realism as a stance for mixed methods research*. In a. Tashakkori & C. Teddlie (Eds). *Sage Handbook of Mixed Methods in Social & Behavioural Research (2nd Edn)*. . Thousand Oaks, CA: Sage.
- McCambridge, J., Witton, J. & Elbourne, D. R. (2014) 'Systematic review of the Hawthorne effect: new concepts are needed to study research participation effects'. *Journal of clinical epidemiology*, 67 (3), pp. 267-277.
- Mertler, C. A. (2001) 'Designing scoring rubrics for your classroom'. *Practical assessment, research & evaluation*, 7 (25), pp. 1-10.
- Michels, M. E., Evans, D. E. & Blok, G. A. (2012) 'What is a clinical skill? Searching for order in chaos through a modified Delphi process'. *Medical teacher*, 34 (8), pp. e573-e581.
- Miller, G. E. (1990) 'The assessment of clinical skills/competence/performance'. *Academic medicine*, 65 (9), pp. S63-67.
- MinistryofHealthScottishHomeandHealthDepartment (1966) *Report by the Ambulance Party on Training and Equipment. Part 1 - Training*. London. Available.
- Moffatt, S., White, M., Mackintosh, J. & Howel, D. (2006) 'Using quantitative and qualitative data in health services research—what happens when mixed method findings conflict?[ISRCTN61522618]'. *BMC Health Services Research*, 6 (1), pp. 28.

Moore, D. A. & Healy, P. J. (2008) 'The trouble with overconfidence'. *Psychological review*, 115 (2), pp. 502.

Moran, T. P. (2016) 'Anxiety and working memory capacity: A meta-analysis and narrative review'. *Psychological Bulletin*, 142 (8), pp. 831.

Murray, D., Boulet, J., Kras, J., McAllister, J. & Cox, T. (2005) 'A Simulation-Based Acute Skills Performance Assessment for Anaesthesia Training'. *Economics, Education and Health Systems Research*, 101 pp. 1127-1134.

Naing, L., Winn, T. & Rusli, B. (2006) 'Practical issues in calculating the sample size for prevalence studies'. *Archives of orofacial Sciences*, 1 pp. 9-14.

NAO (2010) *Major trauma care in England*. London, (Report No. HC 213). Available.

NCEPOD (2007) *Trauma: Who Cares?* London. Available.

Newton, A. (2011) 'Specialist practice for paramedics: a bright future?'. *Journal of Paramedic Practice*, 3 (2), pp. 58-58.

NHSEngland (2013) *High Quality Care for All, Now and for Future Generations: Transforming Urgent and Emergency Care Services in England: Urgent and Emergency Care Review: End of Phase 1 Report*. NHS England.

NHSEngland (2015) *Safer, Faster, Better: good practice in delivering urgent and emergency care. A Guide for local health and social care communities*. . London: NHS England. Available.

NHSEngland (2017) *AHPs into Action. Using Allied Health Professions to transform health, care and wellbeing*. London. Available.

NICE (2008) 'Stroke and transient ischaemic attack in over 16s: diagnosis and initial management (cg68)'. [in London: National Institute for Clinical Excellence. (Accessed:NICE

NICE (2016) 'Sepsis: recognition, diagnosis and early management (ng51)'. [in London: National Institute for Clinical Excellence. (Accessed:NICE

Noble, H. & Smith, J. (2015) 'Issues of validity and reliability in qualitative research'. *Evidence-based nursing*, 18 (2), pp. 34-35.

Norland, E. V. T. (1990) 'Controlling error in evaluation instruments'. *Journal of extension*, 28 (2), pp. 56.

O'Brien, K. K., Colquhoun, H., Levac, D., Baxter, L., Tricco, A. C., Straus, S., Wickerson, L., Nayar, A., Moher, D. & O'Malley, L. (2016) 'Advancing scoping study methodology: a

web-based survey and consultation of perceptions on terminology, definition and methodological steps'. *BMC Health Services Research*, 16 (1), pp. 305.

O'driscoll, B., Howard, L. & Davison, A. (2008) 'BTS guideline for emergency oxygen use in adult patients'. *Thorax*, 63 (Suppl 6), pp. vi1-vi68.

Onwuegbuzie, A. J. & Johnson, R. B. (2006) 'The validity issue in mixed research'. *Research in the Schools*, 13 (1), pp. 48-63.

Orde, S., Celenza, A. & Pinder, M. (2010) 'A randomised trial comparing a 4-stage to 2-stage teaching technique for laryngeal mask insertion'. *Resuscitation*, 81 (12), pp. 1687-1691.

Peate, I. (2015) 'Scope of practice: considering how the role of the paramedic continues to change'. *Journal of Paramedic Practice*, 7 (7), pp. 330-331.

Peirce, C. S. (1984) 'Review of Nichols' A treatise on cosmology'. *Meaning and action. A critical history of pragmatism*. Indianapolis: Hackett, pp. 493-495.

Petter, J. & Armitage, E. (2012) 'Raising educational standards for the paramedic profession'. *Journal of Paramedic Practice*, 4 (4), pp. 241-242.

Peyton, J. (1998) *Teaching and Learning in Medical Practice*. Europe: Manticore.

Pham, M. T., Rajić, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A. & McEwen, S. A. (2014) 'A scoping review of scoping reviews: advancing the approach and enhancing the consistency'. *Research synthesis methods*, 5 (4), pp. 371-385.

Popper, K. R. (1963) 'Science as falsification'. *Conjectures and refutations*, 1 pp. 33-39.

Preston, C. C. & Colman, A. M. (2000) 'Optimal number of response categories in rating scales: reliability, validity, discriminating power, and respondent preferences'. *Acta psychologica*, 104 (1), pp. 1-15.

Pusic, M., Pecaric, M. & Boutis, K. (2011) 'How Much Practice Is Enough? Using Learning Curves to Assess the Deliberate Practice of Radiograph Interpretation'. *Academic medicine*, 86 (6), pp. 731-736.

Pusic, M. V., Kessler, D., Szyld, D., Kalet, A., Pecaric, M. & Boutis, K. (2012) 'Experience curves as an organizing framework for deliberate practice in emergency medicine learning'. *Academic Emergency Medicine*, 19 (12), pp. 1476-1480.

QAA (2016) 'Subject Benchmark Statement Paramedics'. [in UK: Quality Assurance Agency. (Accessed:QAA

Riley, J. (1990) *Getting the most from your data: practical ideas on how to analyse qualitative data*. Technical & Educational Services.

- Risambessy, A., Swasto, B., Thoyib, A. & Astuti, E. S. (2012) 'The influence of transformational leadership style, motivation, burnout towards job satisfaction and employee performance'. *Journal of Basic and Applied Scientific Research*, 2 (9), pp. 8833-8842.
- Roberts, K., Allison, K. & Porter, K. (2003) 'A review of emergency equipment carried and procedures performed by UK front line paramedics'. *Resuscitation*, (58), pp. 153-158.
- Roberts, K., Jewkes, F., Whalley, H., Hopkins, D. & Porter, K. (2005) 'A review of emergency equipment carried and procedures performed by UK front line paramedics on paediatric patients'. *Emergency Medicine Journal*, 22 (8), pp. 572-576.
- Robinson, S. (2017) 'A student perspective: newly qualified paramedic programme'. *Journal of Paramedic Practice*, 9 (6),
- Ross, L., Boyle, M., Williams, B., Fielder, C. & Veenstra, R. (2014) 'Perceptions of student paramedic interpersonal communication competence: A cross-sectional study'. *Australasian Journal of Paramedicine*, 11 (4),
- Ryan, L. & Halliwell, D. (2012) 'Paramedic decision-making—how is it done?'. *Journal of Paramedic Practice*, 4 (6), pp. 343-351.
- Sanson-Fisher, R., Rolfe, I. & Williams, N. (2005) 'Competency based teaching: the need for a new approach to teaching clinical skills in the undergraduate medical education course'. *Medical teacher*, 27 (1), pp. 29-36.
- Sanson-Fisher, R., Rolfe, I. & Williams, N. (2009) 'Competency based teaching: the need for a new approach to teaching clinical skills in the undergraduate medical education course'. *Medical teacher*, 27 (1), pp. 29-36.
- Schalk, R., Byhahn, C., Fausel, F., Egner, A., Oberndörfer, D., Walcher, F. & Latasch, L. (2010) 'Out-of-hospital airway management by paramedics and emergency physicians using laryngeal tubes'. *Resuscitation*, 81 (3), pp. 323-326.
- Schön, D. A. (2017) *The reflective practitioner: How professionals think in action*. Routledge.
- Schuwirth, L. W. & Van der Vleuten, C. P. (2003) 'The use of clinical simulations in assessment'. *Medical education*, 37 pp. 65-71.
- Seok, S., Meyen, E., Decosta, B. & (eds) (2010) *Handbook of Research on Human Cognition and Assistive Technology: design, accessibility and Transdisciplinary Perspectives*. New York: Hershey.
- Shepherd, C., Ambrose, L., Somerville, S. & Ker, J. (2008) 'Medical undergraduates' competence and confidence in basic life support skills: an observational study of

- subjective and objective assessments'. *International Journal of Clinical Skills*, 2 (1), pp. 30-34.
- Shields, A. (2011) 'Paramedic non-technical skills: aviation style behavioural rating systems'. *Journal of Paramedic Practice*, 3 (12), pp. 676-680.
- Shields, A. & Flin, R. (2013) 'Paramedics' non-technical skills: a literature review'. *Emerg Med J*, 30 (5), pp. 350-354.
- Sica, G. T. (2006) 'Bias in research studies'. *Radiology*, 238 (3), pp. 780-789.
- Simmons, B. (2010) 'Clinical reasoning: concept analysis'. *Journal of advanced nursing*, 66 (5), pp. 1151-1158.
- Simundic, A.-M. (2013) 'Bias in research'. *Biochemia medica: Biochemia medica*, 23 (1), pp. 12-15.
- Sjostrand, M., Ericsson, S., Juth, N. & Helgesson, G. (2013) 'Paternalism in the Name of Autonomy'. *The Journal of Medicine and Philosophy*, 38 (6), pp. 710-724.
- Smith, J. & Noble, H. (2014) 'Bias in research'. *Evidence-based nursing*, 17 (4), pp. 100-101.
- Soar, J., Nolan, J. P., Böttiger, B. W., Perkins, G. D., Lott, C., Carli, P., Pellis, T., Sandroni, C., Skrifvars, M. B. & Smith, G. B. (2015) 'European resuscitation council guidelines for resuscitation 2015: section 3. Adult advanced life support'. *Resuscitation*, 95 pp. 100-147.
- Stayt, L. & Merriman, C. (2013) 'A descriptive survey investigating pre-registration student nurses' perceptions of clinical skill development in clinical placements'. *Nurse Education Today*, 33 (4), pp. 425-430.
- Steer, B. (2007) 'Paramedics, consent and refusal – are we competent? '. *Journal of Emergency Primary Healthcare*, 5 (1),
- SWASfT (2018) *Annual Report and Accounts 1 April 2017 – 31 March 2018*. Exeter: SWASfT. Available.
- Syme-Grant, J., Stewart, C. & Ker, J. (2005) 'How we developed a core curriculum in clinical skills'. *Medical teacher*, 27 (2), pp. 103-106.
- Tavares, W. & Mausz, J. (2015) 'Assessment of non-clinical attributes in paramedicine using multiple mini-interviews'. *Emerg Med J*, 32 (1), pp. 70-75.
- Taylor, J., Black, S., Brett, S. J., Kirby, K., Nolan, J. P., Reeves, B. C., Robinson, M., Rogers, C. A., Scott, L. J. & South, A. (2016) 'Design and implementation of the AIRWAYS-2 trial: A multi-centre cluster randomised controlled trial of the clinical and cost effectiveness of the i-gel supraglottic airway device versus tracheal intubation in

the initial airway management of out of hospital cardiac arrest'. *Resuscitation*, 109 pp. 25-32.

Teddlie, C. & Tashakkori, A. (2003) *Handbook of mixed methods in social & behavioral research*. Sage.

Thompson, S. (2015) 'The perceived concerns of newly qualified paramedics commencing their careers: a pilot study'. *Journal of Paramedic Practice*, 7 (2), pp. 74-78.

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D., Horsley, T. & Weeks, L. (2018) 'PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation'. *Annals of Internal Medicine*, 169 (7), pp. 467-473.

Trust, M. S. N. F. (2013) *Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry*. London. Available.

UniversityofPlymouth (2020) 'Ethical Review'. [Online]. Available at: <https://www.plymouth.ac.uk/research/governance/ethical-review>.

Wass, V., Van der Vleuten, C., Shatzer, J. & Jones, R. (2001) 'Assessment of clinical competence'. *The lancet*, 357 (9260), pp. 945-949.

Weller, J. M., Nestel, D., Marshall, S. D., Brooks, P. M. & Conn, J. J. (2012) 'Simulation in clinical teaching and learning'. *Medical Journal of Australia*, 196 (9), pp. 594-594.

Weng, Y.-H., Kuo, K. N., Yang, C.-Y., Lo, H.-L., Chen, C. & Chiu, Y.-W. (2013) 'Implementation of evidence-based practice across medical, nursing, pharmacological and allied healthcare professionals: a questionnaire survey in nationwide hospital settings'. *Implementation Science*, 8 (1), pp. 112.

Willis, E., Williams, B., Brightwell, R., O'Meara, P. & Pointon, T. (2010) 'Road-ready paramedics and the supporting sciences curriculum'. *Focus on health professional education: a multi-disciplinary journal*, 11 (2), pp. 1.

Wisdom, J. P., Cavaleri, M. A., Onwuegbuzie, A. J. & Green, C. A. (2012) 'Methodological reporting in qualitative, quantitative, and mixed methods health services research articles'. *Health services research*, 47 (2), pp. 721-745.

Woodford, P. (2015) 'The decision is yours'. *Journal of Paramedic Practice*, 7 (2), pp. 90-94.

Woolcock, M. (2012) 'Time for paramedic licenses?'. *Journal of Paramedic Practice*, 4 (7), pp. 377-377.

Woollard, M. & Jewkes, F. (2004) '5 Assessment and identification of paediatric primary survey positive patients'. *Emergency Medicine Journal*, 21 (4), pp. 511-517.



Wright, K. (1985) 'Extended training of ambulance staff in England'. *Social science & medicine*, 20 (7), pp. 705-712.

Wyatt, A. (2003) 'Paramedic Practice – Knowledge Invested in Action '. *Journal of Emergency Primary Health Care*, 1 (3-4),

Yerkes, R. & Dodson, J. (1908) 'The relation of strength of stimulus to rapidity of habit-formation'. *Journal of Comparative Neurology*, 18 (5), pp. 459-482.

Zell, E. & Krizan, Z. (2014) 'Do people have insight into their abilities? A metasynthesis'. *Perspectives on Psychological Science*, 9 (2), pp. 111-125.

Zimmerman, B. (2010) 'Self-Regulated Learning and Academic Achievement: An Overview '. *Educational Psychologist*, 25 (1), pp. 3-17.

### **Publication during Study Period**

Henderson, T., Endacott, R., Marsden, J. & Black, S. (2019) 'Examining the type and frequency of incidents attended by UK paramedics'. *Journal of Paramedic Practice*, 11 (9), pp. 396-402.

<https://doi-org.plymouth.idm.oclc.org/10.12968/jpar.2019.11.9.396>



## **Appendices**

### **Appendix 1 - Contextual Background**

#### *Health and Care Professions Council*

In the year 2000 paramedics became registered professionals, initially with the Council for Professions Supplementary to Medicine which was later superseded by the Health Professions Council. The HPC was the regulatory body with responsibility for regulating Allied Health Professionals. In 2012 the name underwent a further change to reflect the inclusion of Social Workers, becoming the Health and Care Professions Council (HCPC); the regulatory body overseeing the paramedic profession has remained unchanged thus far. All paramedic education/training programmes must be periodically reviewed by the HCPC, who then approve the course, if it is fit for purpose. This process ensures that on successful completion of a paramedic programme, candidates who have met the academic requirement can enter the register. This process of approval is carried out through the assessment of a programme against the HCPC Standards of Education and Training (HCPC, 2018a). A programme that meets the SETs should allow successful students to meet the threshold HCPC Standards of Proficiency; this is the minimum level required for safe and effective practice, where the student must be at the completion of their education/training (HCPC, 2014).

#### *College of Paramedics*

The British Paramedic Association (BPA) was formed in 2001; the purpose of this organisation was to represent paramedics in the UK, as required by law for registered professional groups. The BPA had a mandate to represent the

profession as a whole in the UK and were able to offer a picture of what a paramedic should 'look' like.

In 2006 the BPA published the first edition of the curriculum guidance, in 2008 the second edition of this document was published, now under the changed title of the College of Paramedics (CoP), there have since been two more revisions, in addition there is now a postgraduate curriculum guidance document also. The undergraduate guidance document is set out to offer a framework for higher education institutes and other stakeholders in relation training and education provision for paramedics; the guidance documents offer an insight into the required skills of a paramedic but do not list them individually or specifically. In 2017 the fourth and most recent curriculum guidance document was published. The first two curriculum guidance documents had included a competency framework; however, in recognition of the rapidly developing role, the third and fourth edition did not. The CoP decided that this would be produced separately so that the two documents were not tied in.

The function of the curriculum guidance documents is not exclusive to the CoP, they serve to inform stakeholders in paramedic education as to the direction of education/development for the paramedic role (CoP, 2019).

In 2013 the CoP published the Paramedic Evidence Based Education Project (PEEP); this report sought to provide an evidence base business case for the future standardisation of university paramedic education.

Perhaps one of the most significant things that this report did was set a timescale for the profession to become an all graduate profession by 2019 (Lovegrove & Davis, 2013). At the time of its publication paramedics had the lowest entry requirements of all HCPC professionals for the HCPC register, set at certificate level (Lovegrove & Davis, 2013).

The report made specific comment regarding the extent of ongoing development within the paramedic role. In addition, scope of practice was raised with specific comment made on the wide variation found in different areas within the UK. A highlighted lack of consensus by paramedics as to what scope of practice means was also noted (Lovegrove & Davis, 2013). This prompted the CoP to publish the 'Paramedic – Scope of Practice Policy' in 2015, revised in 2018. This document offered some valuable insight into what constitutes 'scope of practice' but was generic in its nature and similarly to the undergraduate curriculum guidance, did not offer a list of specific skills, procedures or capabilities for use by paramedics (CoP, 2018a).

## Appendix 2 – Data Collection Tool

<b>Data collection for phase 1 of PhD - 2014</b>	<b>Comments</b>	General Comments				
	<b>Drugs</b>	Drug Route				
		Drugs given				
	<b>Clinical/Patient Management Skills</b>	Other Skills				
		IV/IO				
		Immobilisation				
		Circulation m/ment				
		Airway m/ment				
	<b>Observations/ Assessment</b>	ECG				
		FAST/ABCD2				
		Additional Observations				
		General Observations				
	<b>Incident Details</b>	Incident Type				
		Patient age				
		Incident locality				
		Station				
		Time with patient				
		Incident No.				
		Time				
		Date				

## v

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## Appendix 4 – Pre Scenario Questionnaire

**Confidential**

### Pre-observation Questionnaire

#### Definitions

##### Confidence

The belief of an individual in their ability to undertake a skill

##### Competence

Having the necessary ability, knowledge or skill to do something successfully

**Participant Number.....**

Please circle your intended response or write the answer clearly in the space provided

1. What is your gender?

Male / Female

2. What is your age?

20-29

30-39

40-49

50-59

60-69

3. How many years have you been a practicing paramedic? If you have had a break/s in your career/practice please specify how many and the length.

Number of years paramedic practice.....

Break/s - Number of breaks..... Length/s.....  
(please specify months or years)

4. What was your training/education route to paramedic qualification (please circle/highlight)?

IHCD

University - Degree/Foundation Degree/Diploma (inc. 'top-up routes)

Armed Forces

Other – please specify.....



5. Please indicate if you are one or more of the following (circle/highlight)?

Current mentor for a Plymouth University paramedic student

Plymouth University Paramedic graduate

Neither

6. What station/area do you work in predominantly?  
(please provide both station and county)

Station..... County.....

**For questions 6 – 9, a score of 0 would indicate a low level and 10 would indicate a high level**

7. On a scale of 0 – 10, please rate your confidence and competence in relation to the use of **manual airway maintenance methods**

Confidence -

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

8. On a scale of 0 – 10, please rate your confidence and competence in relation to the **administration of high flow oxygen**

Confidence -

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

9. On a scale of 0 – 10, please rate your confidence and competence in relation to **intermediate/advanced airway maintenance methods**

Confidence -

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

10. On a scale of 0 – 10, please rate your confidence and competence in relation to the **practice of IV cannulation**

Confidence -

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –

**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

11. How frequent do you think the following skills are used in the context of standard paramedic practice. ie the basic paramedic role, not including specialist paramedic practice.

For this question frequent is considered to occur more than 25% of the time. ie more than 1 in every 4 incidents attended

High flow oxygen administration	Frequent / Infrequent
IV drug administration	Frequent / Infrequent
Manual airway manoeuvres	Frequent / Infrequent
Intraosseous access	Frequent / Infrequent
Intermed/adv airway management (SGA/ETI)	Frequent / Infrequent
Intravenous cannulation	Frequent / Infrequent
Defibrillation	Frequent / Infrequent
Spinal immobilisation	Frequent / Infrequent

12. What are the factors that affect your **confidence**?

Please provide detail below...

.....

.....

.....

.....

13. What are the factors that affect your **competence**?

Please provide detail below...

.....

.....

.....

## Appendix 5 – Clinical Scenario Observation Rubric

### **Confidential** Clinical Skill Observation

Participant Number.....

**This form is to be completed by the researcher, the relevant descriptor for each dimension must be circled as the participant completes the clinical scenario.**

**Conscious patient presents with chest pain...**

**Oxygen Therapy...**

3	2	1	0
Need for high flow O2 recognised in a timely manner, following pt assessment (including SPO2 measurement)	Decides to administer high-flow oxygen based on SpO2, but following an unreasonable delay	Decides to administer oxygen but does so without measurement of SpO2	Does not recognise the need for oxygen and / or does not manage to administer it prior to cardiac arrest
Valid verbal consent actively sought (including verbal confirmation by patient)	Verbal consent actively sought (including verbal confirmation by patient) but done so incompletely	Implied consent achieved, no verbal confirmation given by pt	No discernible consent sought.
Selects the correct equipment and sets it up properly, enabling delivery of the correct dose of oxygen	Selects the correct equipment but sets it up sub-optimally, risking poor oxygen delivery to the patient	Selects the wrong equipment (ie, simple face mask or nasal cannulae) but sets it up correctly	Selects the wrong equipment (ie, simple face mask or nasal cannulae) and sets it up incorrectly <b>OR</b> Does not select equipment
Reassesses the drug intervention and its efficacy in a timely manner	Reassesses the drug intervention and its efficacy but is delayed in doing so	Reassessment of the drug intervention occurs by default during the scenario	Makes no attempt to reassess the drug intervention

Explains all actions to patient in detail throughout scenario	Explains limited actions in detail throughout scenario	Lacks detail and widespread explanation of actions	Offers no explanation of any actions
Demonstrates safe practice throughout the activity	Demonstrates safe practice during the activity but minor issues identified	Demonstrates unsafe practice during the activity	The procedure needed to be interrupted due to the severity of unsafe practice <b>OR</b> was not carried out

#### IV Cannulation...

3	2	1	0
Recognises the need for IV cannulation in a timely manner	Decides to perform IV cannulation but following a delay <b>(prior to cardiac arrest)</b>	Decides to perform IV cannulation but following a delay <b>(following cardiac arrest)</b>	IV cannulation is not attempted/performed
Valid verbal consent actively sought (including verbal confirmation by patient)	Verbal consent actively sought (including verbal confirmation by patient) but done so incompletely	Implied consent achieved, no verbal confirmation given by pt	No discernible consent sought <b>OR</b> consent not considered as IV cannulation not attempted
Selects all required IV equipment prior to procedure <b>OR</b> Works from the response bag in a logical sequence during IV cannulation	Minor omission/s when selecting IV equipment prior to procedure <b>OR</b> Works from the response bag in a slightly disordered manner during IV cannulation	Significant omission/s when selecting IV equipment prior to procedure <b>OR</b> Works from the response bag in a chaotic/random manner	No equipment selection / organisation structure is recognisable as IV cannulation is carried out <b>OR</b> IV cannulation not attempted
The tourniquet is adequately applied, the cannulation site explored and cleansed prior to the cannulation attempt	The tourniquet is adequately applied, cannulation site explored and cleansed prior to the cannulation attempt ; however, an element or elements are done sub-optimally	Tourniquet application, site exploration or cleansing are omitted prior to the cannulation attempt. Everything that is done, is of an optimal standard	Tourniquet application, site exploration or cleansing are omitted prior to the cannulation attempt. In addition elements of what are done are sub-optimal

Successfully places the IV cannula utilising recognised, good practice / technique	Successfully places the IV cannula using sub-optimal practice / technique	Successfully places the IV cannula following multiple attempts (good or poor practice)	Fails to place the IV cannula despite repeated attempts <b>OR</b> does not attempt to cannulate
Following placement, the cannula is competently fixed in position, labelled (time/date) and flushed	Following placement, the cannula is fixed in position, labelled (time/date) and flushed but elements of this are sub-optimal	Some of the elements for securing the cannula and making it ready are missing but those carried out are done competently	Some of the elements for securing the cannula and making it ready are missing as well as being carried out sub-optimally No securing of the/an IV cannula
Takes all available opportunities to minimise infection risk	Employs sporadic strategies to minimise infection risk	Attempts to employ strategies to minimise infection risk but does so inadequately	No infection control measures taken
Explains all actions to patient in detail throughout scenario	Explains limited actions in detail throughout scenario	Lacks detail and widespread explanation of actions	Offers no explanation of any actions
Demonstrates safe practice throughout the activity	Demonstrates safe practice during the activity but minor issues identified	Demonstrates unsafe practice during the activity	The procedure needed to be interrupted due to the severity of unsafe practice <b>OR</b> was not attempted

**Patient suffers cardiac arrest...**

## Basic Airway Management (Manual / Basic Adjuncts)...

3	2	1	0
Opens the airway using manual methods (adequately maintaining the manoeuvre) to check breathing	Opens the airway to check breathing using manual methods but does not maintain the manoeuvre adequately	Attempts to open the airway using an unrecognised technique	Does not attempt to open the airway during the breathing check and / or does not check for breathing
Recognition of the need for intervention (CPR) in a timely manner following assessment and / or examination	Recognition of the need for intervention (CPR) following assessment and / or examination, but following an unreasonable delay	Decision to carry out an intervention (CPR) is not based on a physical assessment and / or examination	No recognition of the need for intervention (CPR) of any sort <b>OR</b> Incorrect intervention carried out
During ventilation, attempts to open the airway using head tilt/chin lift or jaw thrust; utilising recognised, good practice <b>OR</b> Valid justification is offered for bypassing this	During ventilation, attempts to open the airway using head tilt/chin lift or jaw thrust; using sub-optimal practice. Good head positioning achieved	During ventilation, attempts to open the airway using head tilt/chin lift or jaw thrust; using sub-optimal practice. Head positioning poor <b>OR</b> No/invalid justification is offered for bypassing this	No attempt made to maintain the airway using manual manoeuvres during ventilation
Any Intervention and efficacy is reassessed in a timely manner <b>OR</b> reassessment is unnecessary due to justification of missing basic adjuncts	Any Intervention and efficacy is reassessed but there were delays in doing so	Reassessment of the intervention occurs by default during the activity <b>OR</b> reassessment is unnecessary due to missing basic adjuncts, with <u>no / invalid justification</u>	There is no recognisable attempt to reassess the intervention at any point during the activity

<p>Attempts to maintain the airway through insertion of a correctly sized basic airway adjunct, using recognised, good practise <b>OR</b> Valid justification is offered for bypassing this</p>	<p>Attempts to maintain the airway through insertion of a correctly sized basic airway adjunct. Insertion technique/sizing is sub-optimal</p>	<p>Attempts to maintain the airway through insertion of a correctly sized basic airway adjunct. Insertion technique/sizing is inadequate <b>OR</b> No/invalid justification is offered for bypassing this</p>	<p>Fails to attempt maintenance of the airway using basic adjunct.  No justification offered</p>
<p>Any Intervention and efficacy is reassessed in a timely manner <b>OR</b> reassessment is unnecessary due to justification of missing basic adjuncts</p>	<p>Any Intervention and efficacy is reassessed but there were delays in doing so</p>	<p>Reassessment of the intervention occurs by default during the activity <b>OR</b> reassessment is unnecessary due to missing basic adjuncts, with <u>no / invalid justification</u></p>	<p>There is no recognisable attempt to reassess the intervention at any point during the activity</p>
<p>Demonstrates safe practice throughout the activity</p>	<p>Demonstrates safe practice during the activity but minor issues identified</p>	<p>Demonstrates unsafe practice during the activity</p>	<p>The procedure needed to be interrupted due to the severity of unsafe practice</p>

### Failure of basic interventions to maintain the airway...

### Intermediate / Advanced Airway Management (SGA/ETI)...

3	2	1	0
<p>Selects all required airway equipment prior to procedure <b>OR</b> Works from the response bag in a logical sequence during intermediate /</p>	<p>Minor omission/s when selecting airway equipment prior to procedure <b>OR</b> Works from the response bag in a disordered manner during</p>	<p>Significant omission/s when selecting airway management equipment prior to procedure <b>OR</b> Works from the response bag in a</p>	<p>No equipment selection / organisation structure is recognisable as intermediate / advanced airway management is carried out <b>OR</b></p>

advanced airway management	intermediate / advanced airway management	chaotic/random manner	Does not attempt intermediate/ advanced airway management
Selects a correctly sized intermediate / advanced airway adjunct (SGA or ETT)	Selects a correctly sized intermediate / advanced airway adjunct but no obvious measurement made or qualified	Despite correct measurement, incorrect size intermediate / advanced airway adjunct selected	Incorrectly sized intermediate / advanced airway adjunct selected OR Not attempted
Successfully places intermediate/ad advanced adjunct utilising recognised, good practice and procedures. If advanced used, valid justification offered for bypassing intermediate	Successfully inserts intermediate / advanced adjunct using sub-optimal practice and procedures	Successfully manages the airway using intermediate / advanced adjunct following multiple attempts (good or bad practice) <b>OR</b> No/invalid justification is offered for bypassing intermediate adjunct	Fails to adequately maintain the airway using intermediate / advanced techniques <b>OR</b> Not attempted
Timely, complete verification of adjunct placement performed (inc ETCO2)	Timely, incomplete but patient safe verification of adjunct placement performed	Incomplete unsafe AND / OR delayed verification of adjunct placement performed	No attempt at verification of adjunct
Takes all available opportunities to minimise infection risk	Employs sporadic strategies to minimise infection risk	Attempts to employ strategies to minimise infection risk but does so inadequately	No infection control measures taken



Demonstrates safe practice throughout the activity	Demonstrates safe practice during the activity but minor issues identified	Demonstrates unsafe practice during the activity	The procedure needed to be interrupted due to the severity of unsafe practice OR Intermediate/advanced management not attempted
----------------------------------------------------	----------------------------------------------------------------------------	--------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------

**General Comments (to be completed by the researcher)**

Total Scores	Raw mark	%
Oxygen Therapy	/18	%
IV Cannulation	/27	%
Stepwise Airway Management (Basic)	/21	%
Intermediate/Advanced Airway Intervention	/18	%
<b>Total</b>	<b>/87</b>	<b>%</b>

## **Appendix 6 – Phase 2 Scenario Information Planning**

### **Phase 2 – Scenario Information/Planning**

#### **Situation**

Paramedic (working on an RRV) in attendance. They receive a call to a male with chest pain at his home address; call comes from the patient.

#### **Key information in the scenario**

- Paramedic (participant) working alone on an RRV
- 55yr old who lives at home alone. No other family/friends present
- 1 hour history of central, crushing chest pain (ache), radiating down left arm and up into jaw. Associated nausea, patient pale/sweaty
- Patient has past medical history of angina, previous inferior MI 2 years ago, stents fitted. No family history of similar
- Patient has smoked 10 cigarettes/day for 38 years (19 pack years) and drinks approximately 35 units per week
- Patient takes hypertension (atenolol) and hypercholesterolemia (simvastatin) medication
- No OTC medication, no known allergies,
- History/Assessment indicate IV cannulation and following of the MONA mnemonic for cardiac chest pain
- Patient Observations;
  - Alert
  - Maintaining own airway
  - VR – 30
  - SpO2 – 80% (on air)
  - Bilateral clear air entry
  - HR – 48 (radial pulse not palpable)
  - B/P – 90/65
  - Skin – Cool, sweaty, pale
  - Temp – 36.9
  - GCS = 15, slightly agitated
  - ECG (12 lead) – Inferior MI
- Following initial drug therapy (Oxygen, Aspirin, GTN, Morphine), including IV cannulation, patient will deteriorate
- Patient collapses, progressing rapidly to cardiac arrest
- Cardiac arrest – shockable algorithm (VF) throughout
- Will require intermediate or advanced airway intervention to achieve ventilation, patient weight 75KGs
- Following management of the airway to intermediate/advanced level or at 15minutes total, ie phase 1 & 2), the scenario will be stopped.

### **Scenario Timings**

Running time should be approximately **15 minutes**

- 1<sup>st</sup> phase – ACS/chest pain, 9 minutes
- 2<sup>nd</sup> phase – Cardiac Arrest, 6 minutes

Scenario will end during the 2<sup>nd</sup> phase (cardiac arrest), following successful management of the airway with intermediate/advanced methods, or when the scenario reaches 15 minutes total (phase 1 & 2).

### **Required Equipment**

- ALS manikin/Vitasim/Extension Lead
- Response Bag (fully kitted)
- Drugs Bag (kitted with aspirin, GTN and morphine substitute)
- Oxygen & Masks
- Defibrillator
- ECG Leads
- Selection of gloves
- Cannulation Arm/Pad
- Clipboards x 2
- Questionnaire Papers (pre and post)
- Scenario Rubrics
- Consent/Participation Forms
- Camcorder/Tripod/Memory Card

- **Researcher Instructions**

### **Scenario - 55yr old male with chest pain**

#### **Scenario Timings**

Running time should be approximately **15 minutes**

- 1<sup>st</sup> phase – ACS/chest pain, 9 minutes
- 2<sup>nd</sup> phase – Cardiac Arrest, 6 minutes

Scenario will end during the 2<sup>nd</sup> phase (cardiac arrest), following successful management of the airway with intermediate/advanced methods, or when the scenario reaches 15 minutes total (phase 1 & 2).

#### **Set up**

Actor to sit on a chair, behind the chair will be a screen and on the floor behind the screen will be an ALS manikin.

Bring the participant into the room and give them their equipment.

Take note of the time, start the camcorder and then start the scenario

#### **Situation/Actions**

Participant is a Paramedic working alone on a rapid response vehicle (RRV).

They receive an emergency call to a residential address.

Patient at the address is a 55 year old male with a 1 hour history of central chest pain, he lives alone and there are no family or friends present on scene.

On arrival the patient is sitting on a chair, the primary survey elicits the following information;

- Patient is alert
- Maintaining their own airway
- Ventilatory rate – 30
- Oxygen saturation – 80% (on air)
- Bilateral, clear air entry
- Heart rate – 58
- Blood pressure – 95/65
- Skin – Cool, sweaty, pale
- GCS = 15, slightly agitated
- Blood sugar – 5.6

Further assessment of the patient will elicit the following information;

- Temperature – 36.9
- Electrocardiogram (12 lead) – ST elevation in leads 2, 3 and AVF

Assessment of pain would establish the following;

- Site – Central chest
- Onset – 1 hour ago, constant
- Character – Crushing, ache
- Radiation - radiating down left arm and into jaw

- Associations - Nauseous, pale/sweaty
- Time – 1 hour duration
- Exacerbating/relieving factors – exercise increases pain
- Severity – 8/10

Patient has past medical history of angina, previous inferior MI 2 years ago, stents fitted. No family history of similar

Patient takes hypertension (atenolol) and hypercholesterolemia (simvastatin) medication. No OTC medication

No known allergies

Patient has smoked 10 cigarettes/day for 38 years (19 pack years) and drinks approximately 35 units per week

The above history, signs and symptoms indicate IV cannulation and adherence to the 'MONA' mnemonic

Following cannulation **(on a simulation arm)** and the above, initial drug therapy (Oxygen, Aspirin, GTN, Morphine), the patient will deteriorate. They collapse, progressing rapidly to cardiac arrest. **At this point the scenario focus will move from the actor to the manikin which will be set up in the same room.**

The initial and continuing cardiac arrest rhythm will be ventricular fibrillation

During CPR the paramedic is initially unable to adequately maintain the airway, **feedback will be given to the paramedic to indicate that ventilation is difficult.**

Placement of a supraglottic airway or endotracheal tube rectifies this and allows effective ventilation. The patient's estimated weight is 75KGs

**Following management of the airway to intermediate/advanced level or at 15 minutes total running time, ie phase 1 & 2 total), the scenario will be stopped.**

## **Actor Instructions**

### **Scenario - 55yr old male with chest pain**

#### **Scenario Timings**

Running time should be approximately **15 minutes**

- 1<sup>st</sup> phase – ACS/chest pain, 9 minutes (**actor**)
- 2<sup>nd</sup> phase – Cardiac Arrest, 6 minutes (**manikin**)

Actor involvement in the scenario will end following IV cannulation of the simulation arm and administration of relevant cardiac drugs, or at 9 minutes, whichever comes first.

#### **Set up**

For phase 1 of the scenario you will play the part of the patient who has called 999 due to chest pain. For this you will sit on a chair and respond to the participant playing the paramedic.

When the participant has carried out IV cannulation (on the simulation arm) and administered oxygen, aspirin, GTN and morphine, or reach 9 minutes into the scenario, you will simulate collapse. The scenario will then move to a manikin that will be on the floor behind a screen.

#### **Situation/Actions**

You are a 55 year old male who has been experiencing central chest pain for 1 hour, you live alone and there is no one else is currently at your house. You have called 999 as you do not know what else to do.

You are happy to let the participant assess/examine you and you are able to take to the participant to convey information (detailed within these instructions)

If asked about your pain you can offer the following information;

- Site – Central chest
- Onset – 1 hour ago, constant
- Character – Crushing, ache
- Radiation - radiating down left arm and into jaw
- Associations - Nauseous, pale/sweaty
- Time – 1 hour duration
- Exacerbating/relieving factors – exercise increases pain
- Severity – 8/10

If/when asked you can offer the following information;

- You have a past medical history of angina, previous heart attack 2 years ago, stents fitted. No family history of similar
- You take hypertension (atenolol) and hypercholesterolemia (simvastatin) medication. No OTC medication
- No known allergies
- You have smoked 10 cigarettes/day for 38 years (19 pack years) and drink approximately 35 units per week

When the participant has carried out IV cannulation (on the simulation arm) and administered oxygen, aspirin, GTN and morphine, or reach 9 minutes into the scenario, you will simulate collapse. The scenario will then move to a manikin that will be on the floor behind a screen. **At this point the scenario focus will move from the actor to the manikin which will be set up in the same room.**

## **Participant Instructions**

### **Scenario Timings**

Total research participation time should be approximately one hour, **the scenario should last approximately 15 minutes**

### **Set up**

All the equipment you need will be ready and set up for you.

Please treat the patient as if this were real life, carry out any observations that you wish to during the scenario.

If the patient in your scenario is unable to answer your question then the researcher will do so.

### **Situation/Actions**

You are a Paramedic working alone on a rapid response vehicle (RRV). You have received an emergency call to a residential address, for a 55 year old male with a 1 hour history of central chest pain.



## Appendix 7 – Post Scenario Questionnaire Confidential

### Post-observation Questionnaire

#### Definitions

##### Confidence

The belief of an individual in their ability to undertake a skill

##### Competence

Having the necessary ability, knowledge or skill to do something successfully

#### Participant Number.....

Please answer the following questions in relation to the scenario you have just taken part in.

**For questions 13 – 16, a score of 1 would indicate a low level and 10 would indicate a high level**

1. On a scale of 0 – 10, please rate your confidence and competence in relation to the use of **manual airway maintenance methods**

Confidence -  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

2. On a scale of 0 – 10, please rate your confidence and competence in relation to the **administration of high flow oxygen**

Confidence -  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

3. On a scale of 0 – 10, please rate your confidence and competence in relation to **intermediate/advanced airway maintenance methods**

Confidence -  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

Competence –  
**Low** 0 1 2 3 4 5 6 7 8 9 10 **High**

4. On a scale of 0 – 10, please rate your confidence and competence in relation to the **practice of IV cannulation**

Confidence -  
**Low** 0    1    2    3    4    5    6    7    8    9    10    **High**  
 Competence –  
**Low** 0    1    2    3    4    5    6    7    8    9    10    **High**

**Questions 5 – 8 are linked to the confidence/competence scores you provided in questions 1 – 4. You need only answer the relevant question if you provided a score of ≤3 indicating a low level or ≥8 indicating a high level.**

5. If your **confidence** was **low** whilst using any of the skills within the scenario why do you think that was?

.....  
 .....  
 .....

6. If your **competence** was **low** whilst using any of the skills within the scenario why do you think that was?

.....  
 .....  
 .....

7. If your **confidence** was **high** whilst using any of the skills within the scenario why do you think that was?

.....  
 .....  
 .....

8. If your **competence** was **high** whilst using any of the skills within the scenario why do you think that was?

.....  
 .....

9. Which of the following skills did you find the easiest to perform (please circle)?

Basic Airway Maintenance (Manual Methods)

Oxygen administration

IV Cannulation

Intermediate Airway Maintenance (IGel/SGA)

10. Which of the following skills did you find the most difficult to perform (please circle)?

Basic Airway Maintenance (Manual Methods)

Oxygen administration

IV Cannulation

Intermediate Airway Maintenance (IGel/SGA)

**Thank you for your time and involvement in this study**

## Appendix 8 - Phase 1 Ambulance Service Ethical Approval

[REDACTED]

[REDACTED]

Tristan Henderson  
Plymouth University  
Room SF32  
Peninsula Allied Health Centre  
Derriford Road  
Plymouth. PL6 8BH

01 July 2014

Dear Tristan

**Re: A retrospective review of ambulance service clinical records**  
**Trust Ref: 14-004**

NHS permission for the above research has been granted on the basis of the information provided in the application form, protocol and supporting documentation. The documents reviewed were:

proposal	v2	02 June 2014
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Your attention is drawn to the attached conditions of approval.

We would like to wish you every success with the project and look forward to seeing the results.

Yours sincerely



[REDACTED]  
**Medical Director**

Encs

CC(s) –  
Professor Ruth Endacott, Plymouth University  
Professor Jonathan Marsden, Plymouth University  
Research and Audit Department [REDACTED]

## Appendix 9 – Phase 1 Faculty Ethical Approval



7<sup>th</sup> July 2014

**CONFIDENTIAL**

Tristan Henderson  
Room SF32  
Peninsula Allied Health Centre  
Derriford Road  
Plymouth  
Devon  
PL6 8BH

Dear Tristan

**Application for Approval by Faculty Research Ethics Committee**

***Reference Number: 13/14-272***

***Application Title: A retrospective review of ambulance service clinical records.***

I am pleased to inform you that the Committee has granted approval to you to conduct this research.

Please note that this approval is for three years, after which you will be required to seek extension of existing approval.

Please note that should any MAJOR changes to your research design occur which effect the ethics of procedures involved you must inform the Committee. Please contact Sarah Jones (email [sarah.c.jones@plymouth.ac.uk](mailto:sarah.c.jones@plymouth.ac.uk)).

Yours sincerely

**Professor Michael Sheppard, PhD, AcSS,**  
Chair, Research Ethics Committee -  
Faculty of Health & Human Sciences and  
Peninsula Schools of Medicine & Dentistry

Faculty of Health & Human Sciences  
Plymouth University  
Drake Circus  
Plymouth PL4 8AA

T +44 (0)1752 585339  
F +44 (0)1752 585328  
E [sarah.c.jones@plymouth.ac.uk](mailto:sarah.c.jones@plymouth.ac.uk)  
W [www.plymouth.ac.uk](http://www.plymouth.ac.uk)

Professor Michael Sheppard  
CQSW BSc MA PhD AcSS  
Chair, Faculty Research Ethics  
Committee

## Appendix 10 – Phase 2 Health research Authority Approval



Health Research Authority

Mr Tristan J Henderson  
Lecturer in Paramedicine / PhD student  
Plymouth University  
Plymouth University  
Plymouth  
PL6 8BH

Email: [hra.approval@nhs.net](mailto:hra.approval@nhs.net)

12 December 2016

Dear Mr Henderson

### Letter of HRA Approval

Study title:	A comparison of actual and self-perceived competence in paramedics during a structured clinical scenario
IRAS project ID:	208829
Protocol number:	FHHS-208829-TH-006
REC reference:	16/HRA/5614
Sponsor	Plymouth University

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

#### Participation of NHS Organisations in England

The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

*Appendix B* provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. Please read **Appendix B** carefully, in particular the following sections:

- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

It is critical that you involve both the research management function (e.g. R&D office) supporting each organisation and the local research team (where there is one) in setting up your study. Contact details and further information about working with the research management function for each organisation can be accessed from [www.hra.nhs.uk/hra-approval](http://www.hra.nhs.uk/hra-approval).

## Appendices

The HRA Approval letter contains the following appendices:

- A – List of documents reviewed during HRA assessment
- B – Summary of HRA assessment

## After HRA Approval

The attached document *“After HRA Approval – guidance for sponsors and investigators”* gives detailed guidance on reporting expectations for studies with HRA Approval, including:

- Working with organisations hosting the research
- Registration of Research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics and is updated in the light of changes in reporting expectations or procedures.

## Scope

HRA Approval provides an approval for research involving patients or staff in NHS organisations in England.

If your study involves NHS organisations in other countries in the UK, please contact the relevant national coordinating functions for support and advice. Further information can be found at <http://www.hra.nhs.uk/resources/applying-for-reviews/nhs-hsc-rd-review/>.

If there are participating non-NHS organisations, local agreement should be obtained in accordance with the procedures of the local participating non-NHS organisation.

## User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please email the HRA at [hra.approval@nhs.net](mailto:hra.approval@nhs.net). Additionally, one of our staff would be happy to call and discuss your experience of HRA Approval.

## HRA Training

We are pleased to welcome researchers and research management staff at our training days – see details at <http://www.hra.nhs.uk/hra-training/>

Your IRAS project ID is 208829. Please quote this on all correspondence.

IRAS project ID	208829
-----------------	--------

Yours sincerely

Rekha Keshvara  
Assessor

Email: [hra.approval@nhs.net](mailto:hra.approval@nhs.net)

Copy to: *Ms Pam Baxter*

[REDACTED]

XXX



## Appendix 11 – Phase 2 Ambulance Service Ethical Approval

Tristan Henderson  
Plymouth University  
Room SF32  
Peninsula Allied Health Centre  
Derriford Road  
Plymouth. PL6 8BH

8<sup>th</sup> August 2016

Dear Tristan

**Re: A comparison of actual and self-perceived competence and confidence in paramedics during a structured clinical scenario.**

**Trust Ref: 14-004**

This Letter confirms the continued approval your project to include phase 2. The documents reviewed were:

Research Proposal	27/06/2016
-------------------	------------

We would like to wish you every success with the project and look forward to seeing the results.

Yours sincerely

**Research and Audit Manager**

Encs

CC(s) –  
Professor Ruth Endacott, Plymouth University  
Professor Jonathan Marsden, Plymouth University  
Research and Audit Department, [REDACTED]

## Appendix 12 – Phase 2 Faculty Ethical Approval



14<sup>th</sup> February 2017

### CONFIDENTIAL

Tristan Henderson  
Plymouth University  
Peninsula Allied Health Centre  
Derriford Road  
Plymouth  
PL6 8BH

Dear Tristan

### Application for Approval by Faculty Research Ethics Committee

**Reference Number:** (16/17)-699

**Application Title:** A comparison of actual and self-perceived competence in paramedics during a structured clinical scenario

I am pleased to inform you that the Committee has granted approval to you to conduct this research.

Please note that this approval is for three years, after which you will be required to seek extension of existing approval.

Please note that should any MAJOR changes to your research design occur which effect the ethics of procedures involved you must inform the Committee. Please contact Sarah Jones (email [sarah.c.jones@plymouth.ac.uk](mailto:sarah.c.jones@plymouth.ac.uk)).

Yours sincerely

**Professor Michael Sheppard, PhD, FAcSS**

Chair, Research Ethics Committee -  
Faculty of Health & Human Sciences and  
Peninsula Schools of Medicine & Dentistry

Faculty of Health & Human Sciences  
Plymouth University  
Drake Circus  
Plymouth PL4 8AA

T +44 (0)1752 585339  
F +44 (0)1752 585328  
E [sarah.c.jones@plymouth.ac.uk](mailto:sarah.c.jones@plymouth.ac.uk)  
W [www.plymouth.ac.uk](http://www.plymouth.ac.uk)

Professor Michael Sheppard  
CQSW BSc MA PhD FAcSS  
Chair, Faculty Research Ethics  
Committee

## Appendix 13 – Phase 2 Participant Consent Sheet



Participant Number	
--------------------	--

### CONSENT FORM

**Title of Project:** A comparison of actual and self-perceived competence in paramedics during a structured clinical scenario

**Name of Researcher:** Tristan Henderson

Please initial box

1. I confirm that I have read the information sheet (dated Aug 2016) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

☐

2. I understand that my participation is voluntary and that up until the point of data anonymisation I am free to withdraw at any time without giving any reason.

☐

3. I understand the above study will involve the audio visual recording of my participation in a clinical scenario.

☐

4. I agree to take part in the above study.

☐

_____	_____	_____
Name of Participant	Date	Signature

_____	_____	_____
Name of Person taking consent	Date	Signature

Consent Form: IRAS ID 208829 | 12/12/2016 | Version 1.0  
When completed: 1 for participant, 1 for researcher

## **Appendix 14 – Phase 2 Participant Information Sheet**

School of Health Professions, Plymouth University, Derriford Road, Plymouth, PL6 8BH



### **Participation Information Sheet – V1.0**

**Study Title - A comparison of actual and self-perceived competence in paramedics during a structured clinical scenario**

#### **Introduction**

This study is part of a PhD being undertaken by the Chief Investigator (Tristan Henderson – further details below). The wider PhD is looking at what incidents UK Paramedics attend and the frequency of skills practice in relation to their confidence and competence.

Paramedic practice is a rapidly evolving clinical area. They are expected to operate in challenging environments, using a growing number of sometimes rarely practiced skills that may be simple or complex in nature. The challenging environment that Paramedics practice within, combined with the occasional nature of some skills raises the question of how confident/competent they may be in such situations.

You are invited to participate in a study that aims to explore paramedic performance and perception of performance in relation to complex and simple, frequent and infrequently used skills.

Thank you for taking the time to read this information and for considering your participation.

### **Purpose of the Study**

This study aims to establish whether performance and perception of performance differ when measured against paramedic skills of differing complexity, used with varying frequency.

The data collected and conclusions drawn will allow strategies to be developed so paramedic practice can be optimised; ultimately benefiting the patients and service users, as well as the Trust and wider NHS.

### **Why have I been invited to take part?**

You have been invited to take part as an Ambulance Paramedic employee within the local Ambulance Service Trust.

All Paramedics within the local Ambulance Service Trust are eligible to take part, provided that they practice in a non-specialist role.

### **Do I have to take part?**

You do not have to take part in this study, participation is entirely voluntary. If you decide to take part but later change your mind you will be able to withdraw up until the point of data anonymisation.

### **What will happen to me if I take part?**

Participation in this study will involve a simulated clinical scenario, as a Paramedic; the scenario will include the practice of various clinical procedures. Prior to, and following the scenario you will be asked to complete a questionnaire to elicit some minimal demographic detail as well as information in relation to how you feel about your performance.

Data collection for this research will take place across multiple ambulance station sites within the local Ambulance Service Trust, and one static site which is within Plymouth University (the Peninsula Allied Health Centre, Plymouth, PL6 8BB).

On deciding to proceed with participation in the study, you will have the opportunity to choose the day/time/location that suits you best for the data collection to take

place. On arrival at your chosen data collection day, there will be an opportunity to ask any questions you may have before proceeding. Provided you feel comfortable to continue you will be asked to confirm that you have understood the information sheet and to complete the study consent form.

When consent has been provided the data collection will commence, this process should take about one hour on a single occasion and can be approximately broken down as follows;

1. Briefing (10 mins)
2. Pre-scenario Questionnaire (10 mins)
3. Clinical scenario (15 mins)
4. Post-scenario Questionnaire (10mins)
5. Debriefing (15 mins)

The scenario will be filmed to enable later review for accuracy of data collection. Footage can also be supplied to participants at a later time if required, this provision is intended to enable further reflection and learning for the participant (the video footage will be kept securely and not shared with any outside agency).

**What are the potential benefits in taking part?**

This study provides a rare, valuable opportunity for reflection on practice through a simulated clinical scenario, in a safe and confidential environment. Participation will serve to benefit you in terms of confidence, awareness and development.

In addition, this study enables the advancement of paramedicine through the involvement of paramedics in paramedic specific research, thus benefitting the existing and future profession.

**What are the potential disadvantages of taking part?**

There is a time commitment involved when participating in this study.

It is understood that taking part in a filmed, simulated clinical scenario may feel uncomfortable and there is a possibility that you could feel distressed as a result during the data collection episode. In the event of this situation the simulated

scenario would be immediately stopped and support offered to you via a debrief. If you continue to feel distress then you would be further signposted to points of support.

It is possible that there will be identification of training/education needs following participation, this is positive and will facilitate personal practice improvement and therefore better/safer future practice during real incidents.

Should concerns be raised about performance during data collection then this will be addressed via the debrief. Following this initial support and discussion you will be guided to contact your line manager to seek any necessary further support.

Your professional registration requires you to ensure you are competent in the area/s of your work field.

It is hoped that the provision of video footage will further facilitate learning and improvement for participants.

Any training/education needs identified will remain confidential and will not be shared with anyone other than the participant by the researcher. Participants will be encouraged to take responsibility for their own training needs following data collection if any educational needs have been identified.

**What if I have concerns about the study or how it is conducted?**

If you have concerns about any aspect of this study, such as the way you have been approached as a potential participant, and wish to raise them officially, please use the contact details below;

Dr Ruth Endacott, Director of Centre for Health and Social Care Innovation -  
[ruth.endacott@plymouth.ac.uk](mailto:ruth.endacott@plymouth.ac.uk)

Or

[hhsethics@plymouth.ac.uk](mailto:hhsethics@plymouth.ac.uk)

**Will my taking part in the study be kept confidential?**

Your involvement in this study will not be communicated to anyone not directly involved with the research; for example, it will not be passed on to the local Ambulance Trust.

Data will be stored securely at all times; electronic information will be kept on a password protected computer, stored securely and hard copy data locked in a filing cabinet within a private office (also locked).

Anonymisation will be carried out as soon as possible following data collection to protect your confidentiality.

**What will happen if I don't want to carry on with the study?**

Partial anonymisation of data will occur when a participant number is allocated during data collection; when the data is collated it will no longer be possible to trace this back to a participant using the consent sheet.

Participants have the right to withdraw from the study at any point up until the data is fully anonymised (collation of data). In this event, no reason need be given; there will be no subsequent detriment to their relationship with the university and/or the research team. If a decision to withdraw is made, this can be communicated to the chief investigator (Tristan Henderson) during or immediately following data collection.

Following withdrawal, any video footage and data collection sheets will be confidentially destroyed. Following anonymisation it will not be possible to withdraw your data as it will be non-identifiable.

**What will happen to the results of the study?**

It is planned that the results of this study, including direct (anonymised) quotes, will be published in peer review journals and presented at conferences, both nationally and internationally.



School of Health Professions, Plymouth University, Derriford Road, Plymouth, PL6 8BH

In addition to the above, a report will be provided for the local Ambulance Service Trust in order that participants can see what they have contributed to.

It is hoped that the results will inform paramedic education/practice.

**Who is organising and funding the study?**

The study is part of an ongoing PhD being undertaken by Tristan Henderson, Paramedic, Lecturer in Paramedicine. It is being supported by Plymouth University.

A small research grant has been awarded by the College of Paramedics for the study.

**Who has reviewed the study?**

The study has been developed within a PhD supervisory team. Following this informal opinion has been sought from the local Ambulance Service Trust and the Sponsors Representative for Plymouth University.

The study has received approval from the NHS Health Research Authority and the Faculty of Health and Human Sciences Ethics Committee of Plymouth University.

**Contact Details -**

**Chief Investigator**

Mr Tristan Henderson, MCPara – Lecturer in Paramedicine  
School of Health Professions  
Plymouth University  
Peninsula Allied Health Centre  
Derriford Road  
Plymouth  
PL6 8BH  
Phone (work) – 01752 588821  
Phone (mobile) – 07590 465005  
Email – tristan.henderson@plymouth.ac.uk

**Research Supervisor**

School of Health Professions, Plymouth University, Derriford Road, Plymouth, PL6 8BH

Dr Ruth Endacott – Director, Centre for Health and Social Care Innovation

8 Portland Villas

Plymouth University

Drakes Circus

Plymouth

Devon

PL4 8AA

Phone (work) – 01752587588

Email – [ruth.endacott@plymouth.ac.uk](mailto:ruth.endacott@plymouth.ac.uk)

**Thank you for your interest in participating**

## Appendix 15 - Skills Difficulty Table

Skill Level	ACA	ECA / Student Para	Advanced Tech	Paramedic
Difficulty (Based on Skill Level)	0	1	2	3
General Obs	VR	BP	GCS	
	Pulse	SPO2	Pupillary Response	
	Partial Set (complexity based on what has been carried out)		Complete Set	
Additional Obs	Temp	PEF		
		ETCO2		
		HGT		
		Pain		
FAST / ABCD2	FAST		ABCD2	
ECG		3 lead		
		12 lead		
Airway Management	Manual	Suction	SGA	ETI
		OP		Needle Cric
		NP		*Surgical Cric
Breathing Management	BVM			Needle Thorac
Circulation Management	Compressions	Haem Cont Dres	**Defib Manual	
		CAT		
Immobilisation		Vac Mat		
		Vac Splint		
		Traction Splint		
		Pelvic Binder		
		Long Board		
		Scoop/Ortho Str		
IV / IO			IV	
			IO	
Skill Level	ACA	ECA / Student Para	Advanced Tech	Paramedic
Drugs	Oxygen	Entonox	Aspirin	Epinephrine (IV & IO)
Administered			Chlorphenamine (IM)	Amioderone
			Epinephrine (IM)	Atropine
			Glyceryltrinitrate	Benzylpenicillin
			Glucagon	Cyclizine
			Hydrocortisone (IM)	Cefotaxime
			Paracetamol (PO)	Chlorphenamine (IV)
			Sodium Chloride 0.9% (flush)	Diazepam
			Salbutamol	Frusomide
			Ipratropium	Hydrocortison(IV)
			Naloxone (IM)	Glucose (IV)
			Epinephrine (IM)	Heparin
			Glucose Gel	Morphine
			Water for Inj	Paracetamol (IV)
				Prednisolone
				Prochlorperazine
				Sodium Chloride (flush and inf)
				Tenectoplas
Drugs Route	INH		NEB	IV
			PO	IO
			SL	PR
			IM	
			SC	

## Appendix 16 – Skills Difficulty Refined Table

Difficulty Refined				
Skill Level	ACA	ECA / Student Para	Advanced Tech	Paramedic
Difficulty (Based on Skill Level)	1 (simple)		2 (complex)	
General Obs	VR	BP	GCS	
	Pulse	SPO2	Pupillary Response	
	Partial Set		Complete Set	
Additional Obs	Temp	PEF		
		ETCO2		
		HGT		
		Pain		
FAST / ABCD2	FAST		ABCD2	
ECG		3 lead		
		12 lead		
Airway Management	Manual	Suction	SGA	ETI
		OP		Needle Cric
		NP		*Surgical Cric
Breathing Management	BVM			Needle Thorac
Circulation Management	Compressions	Haem Cont Dres	**Defib Manual	
		CAT		
Immobilisation		Vac Mat		
		Vac Splint		
		Traction Splint		
		Pelvic Binder		
		Long Board		
IV / IO			IV	
			IO	
	ACA	ECA / Student Para	Advanced Tech	Paramedic
	Oxygen	Entonox	Aspirin	Epinephrine (IV & IO)
			Chlorphenamine (IM)	Amioderone
			Epinephrine (IM)	Atropine
			Glyceryltrinitrate	Benzylpenicillin
			Glucagon	Cyclizine
			Hydrocortisone (IM)	Cefotaxime
			Paracetamol (PO)	Chlorphenamine (IV)
			Sodium Chloride 0.9% (flush)	Diazepam
			Salbutamol	Frusomide
			Ipratropium	Hydrocortisone (IV)
			Naloxone (IM)	Glucose (IV)
			Epinephrine (IM)	Heparin
			Glucose Gel	Morphine
			Water for Inj	Paracetamol (IV)
				Prednisolone
				Prochlorperazine
				Sodium Chloride (flush and inf)
				Tenectopase
	INH		NEB	IV
			PO	IO
			SL	PR
			IM	
			SC	

# Appendix 17 – Provisional Diagnosis Codes and Incident Groups

PROVISIONAL DIAGNOSIS CODES		Psychiatric / Mental Health Act		Deliberate Self Harm		Environmental	
Respiratory	M01	Asthma	Section 2 (admission for assessment)	D01	Overdose - opiate	E01	Hypothermia - dry
	M02	COPD	Section 3 (admission for treatment)	D02	Overdose - non opiate	E01 A	Hypothermia - wet
	M03	Smoke inhalation	Section 4 (admission for emergency assessment)	D03	Overdose - unspecified	E03	Hazt illness
	M04	Hyperinflation	Section 131 (informal / voluntary admission)	D04	Hanging	E04	Electrocution
	M05	Chest infection	Section 135 (place of safety order - private)	D05	Self wounding - cut/slash	E05	Chemical contamination
	M06	Croup / Epiglottitis	Section 136 (place of safety order - public)	D06	Self wounding - gunshot	E06	Downing / near drowning
	M07	Choking foreign body	Psychiatric other	D07	Self wounding - unspecified	E07	Environmental - unspecified
	M08	Choking other	Anxiety / Depression				
	M09 A	Respiratory other					
	M09 B	Pulmonary embolism					
Cardiac	M10	Cardiac arrest before amb. arrival	Obstetrics / Gynaecology	Trauma (excluding Self Harm)		Social	
	M11	Cardiac arrest after amb. arrival	M32	T01	Head injury - closed	S01	Assist / put to bed
	M12	Chest pain unspecified	M33	T02	Head injury - open	S02	Personal alarm - social need only
	M12 A	Chest pain STEMI	M34	T03	Head injury other	S03	Social need - unspecified
	M12 B	Chest pain NSTEMI	M35	T03 A	Head wound	S04	Fall non-injury
	M13	Chest pain Angina	M36	T03 B	Maxillofacial injuries		
	M14	LVF / TCF	M37	T04	Chest injury - blunt		
	M15	Acute coronary syndrome	M38	T05	Chest injury - penetrating		
	M15 A	Pericarditis	M39	T06	Chest injury - unspecified		
	M15 B	Atrial fibrillation	M40	T07	Abdo / pelvic injury - blunt		
Neurological	M16	Stroke	M41	T08	Abdo / pelvic injury - penetrating		
	M16 A	TIA	M42	T09	Abdo / pelvic - unspecified		
	M17	Single convulsion (non trauma)	M43	T10	Spinal injury - cervical		
	M18	Multiple convulsions (non trauma)	M44	T11	Spinal injury - thoracic / lumbar / sacral		
	M19	Paralysis / numbness (non trauma)	M45	T11 A	Back pain		
	M20	Neurological other		T12	Leg injury		
	M20 A	Meningitis		T12 A	Leg fracture		
	M20 B	Febrie convulsion		T12 B	Shin flap laceration		
				T12 C	Neck of femur		
				T12 D	Foot / ankle injury		
Gastrointestinal	M21	Acute abdomen	Poisoning (accidental)		T12 E	Knee injury	
	M22	GI haemorrhage	M46	T13	Arm injury		
	M23	Diarrhea & vomiting	M47	T13 A	Arm fracture		
	M24	Gastrointestinal other	M48	T13 B	Hand / wrist injury		
	M24 A	Bowel obstruction	M49	T13 C	Shoulder injury		
	M24 B	PV bleed	M50	T14	Traumatic amputation - upper limb		
	M24 C	PR bleed	M51	T15	Traumatic amputation - lower limb		
	M24 D	Catheter problems	M52	T16	Trauma capitate arrest		
	M24 E	Haematemesis		T16 A	Trauma other		
	M24 F	Haematuria		T16 B	Trauma multibody		